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AGRICULTURAL GAZETTE

. . OF . .

NEW SOUTH WALES.

Issued by Direction of

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Agricultural Gazette of New South Wales.

Irrigation.

W. J. ALLEN.

To Australia this word means more than the majority of the present generation may imagine, as, owing to the erratic nature of the seasons in our dryer interior districts, one cannot depend upon any two seasons being at all alike. Some years we have good early rains in the fall, which provide plenty of good green feed for all the stock, as well as moistening the ground so that

Land suitable for fruit-growing under irrigation on the Murray. Before clearing.

ploughing for wheat may be proceeded with; and during such years there are enormous increases in stock and big clips of wool, and every-one is happy. The next year the rainfall may be nearly as great as during the preceding, and perhaps the yield of wheat may be about the same, but in place of the rain falling early there may not be sufficient to start the feed growing until well into the winter, with the result that, owing to the lack of green feed, most of the lambs die, or are, perhaps, killed to save the ewes. The wool is not so good, nor is the clip so heavy or valuable as during the previous more favourable season. While we can never hope to help all those interested in stock and wheat growing, it will be possible to help hundreds of those who are already on the soil, as well as putting thousands more on smaller holdings, varying from 10 to 100 acres, on areas of which size, with the aid of water, they will be able to make very comfortable livings, provided always that we can conserve a little of the rain which falls, and put it on the land at a reasonable cost. Owing to the very flat nature of most of our country there are very few places where this can be done by gravitation;

Mallee Land suitable for lucerne-growing in the Balranald District. Before clearing.

there are, however, many places where, by the use of the most up-to-date pumps, water can be lifted from our rivers at a fairly reasonable cost. Of course, wherever pumping has to be undertaken, the expense of fuel is an item for consideration; so that wherever it is possible to formulate a scheme of irrigation where the water can be made to gravitate from its source, even though the initial cost may be ever so much greater, it will in the end be by far the most economical.

Unfortunately for Australia, until such time as her rivers are locked there are few places where the starting of such a scheme as this latter would be practicable, while, on the other hand, there are hundreds of places where water could be lifted and made to cover land, which would at least help to save millions of stock during our bad seasons; and even were the rivers

Bend of the Murray River at Red Cliffs (120 feet high).

locked, the majority of landowners along their banks would in all probability still have to pump the water required for irrigation purposes; but, even with the extra cost which pumping means compared with gravitation, what better means of insurance could we have?

Scene on the Darling.

It was shown only a few years ago that 1 acre of lucerne under irrigation would keep seventy-five sheep in fairst ore condition; what, then, would it have meant during the drought if in different parts of our State we had had, say, 2,000 stock-owners, each holding anywhere from 3 to 600 acres of lucerne under cultivation during such a year?

If there were a few locks in the Darling, Murrumbidgee, Macquarie, and Edwards rivers, and the landowners were to take up this important question in earnest, it would be quite possible for Australia, without any risk, to carry double the quantity of stock she has ever carried, and to grow about twice the wheat she is now growing. Such a state of things cannot be

Pumping Plant in use on Moorara Station, on the Darling.

brought about all at once, as the people have to be educated up to the manner of using the water before they will understand its many advantages.

There seems to be in the minds of a great number of Australians a strong prejudice against starting any large scheme of irrigation. While such is the case it will be wise to hasten slowly until the benefits to be derived are more thoroughly understood. It is not at all unlikely that should the Government start a good scheme, that it will be some years before the public will appreciate their efforts, and they need not feel discouraged if they find themselves the subject of much adverse criticism; but let them start on good sound business lines, by securing a good supply of water and delivering it in good channels (which are lined where necessary so as to avoid seepage), then establish a good experimental station, where the work is carried out in the most up-to-date practical manner, for the benefit of those who are

Main Channel at Mildura, 18 feet wide at bottom.
(Lined with concrete.)

interested in this work, and it will not be long before the public will begin to realise that the State acted wisely when it began a system of water conservation and irrigation.

Subsidiary Channel—about 18 inches at bottom.
(Lined with concrete.)

To bring such a scheme to a successful issue, good scientific and highly practical men with plenty of push and energy are required to carry it along until it is once thoroughly established.

In looking over the work that has been done up to the present in the State, one has to admit that we have not yet made a start. In two or three places a few hundred acres have been cut up and arrangements made to provide would-be settlers with water, but from lack of knowledge rather than every good intention such schemes were started on soil which was quite unfit for the purpose, with the result that to-day we are no further ahead than we were ten years ago. The little which has been done, however, has taught us which are the most suitable lands to place under irrigation, also which land to avoid. This in itself is a valuable lesson, and one which, I presume, has not been too dearly paid for.

Wherever irrigation has been carried out on good loamy soil which has had a fair natural drainage, good results have been obtained ; and it is on

Mr. Shepherd's Orchard on the Nepean. Irrigating Orange Trees through furrows.

such lands, whether they be alluvial, such as are found in many of our river flats or the light medium loamy soil with or without limestone nodules in the subsoil, that we will find some of our best land for growing crops under irrigation.

The Works Department have at present under consideration a large scheme which should commend itself to the public, as the water is to be delivered by gravitation on to some of the best land we have for irrigation purposes. There are several different classes of land, some of which is suitable for growing the very best fruits for either drying or the fresh fruit trade, while some is first-class lucerne land which will produce six cuts of hay per annum. Other portions are suitable for the growth of sorghum, wheat, vegetables, cotton, tobacco, &c., &c. Dairying and raising lambs for export and pigs for bacon will also be profitable industries to take up. In our warm climates with a sufficient supply of water intelligently applied to our best lands there should be no such thing as failure, and there is no pleasanter life, nor is there any more healthy calling. In such a place it is possible to grow nearly everything that is required—the wool, meat, wheat, vegetables, fresh and dried fruits, poultry, tobacco, &c., &c.

Apart from the question of land suitable for irrigation and a supply of good pure water free from any injurious ingredients, is the question of the application of same to the different crops, and of which there are two methods usually followed, that is flooding and furrows.

Orange Trees growing under irrigation on the Darling (Moorara Station).

Sub-irrigation is practised on a limited scale in some few places, but is rather an expensive undertaking. The furrow system is that most generally used wherever it is practicable, as it has the merit of being most economical; there is the minimum loss of water through evaporation : and it can be so handled that the land receives an even soaking. There is very little, if any, waste water, and the furrows can be cultivated in as soon as they are dry enough, and land well cultivated after being irrigated retains the moisture, the loose soil on the top acting as a mulch and preventing its escape. It will, therefore, be seen that crops so watered and worked will require less frequent waterings than where cultivation is not carried out.

In irrigating through furrows care should be taken to see that just sufficient water is turned into a furrow to keep it wet from top to bottom, as by so doing the land receives a thorough soaking without damage by scouring, as is the case when an unnecessary large quantity of water is allowed to run.

In America, it is not an unusual sight to see fluming in place of earthen head-channels, and the water is turned into the furrows by opening a small slide made of thin galvanised iron, which can be so regulated as to permit just the desired quantity of water to run into any one furrow, and one man can attend to several hundred furrows with but little trouble, if the land is properly levelled and the head-channels or flumes are properly constructed.

Lucerne growing under irrigation—a fortnight after being cut.

All land required for irrigation should, therefore, be levelled, and suitable head-channels made, before any attempt is made to run water, as much trouble and labour in after years can be avoided by attending to this work. In ordinary earth-channels, it is well to have drops at convenient distances, so that by closing one, or putting in an extra slide in same, it will raise the water sufficiently high to divert it into the different furrows. Holes may be cut into the side of the head-drain, to allow the water to run into the furrows, and straw, weeds, or hessian may be used for equalising the flow of water, as it will be found that some furrows will have more water than others. Of course, this is more of a makeshift, and sluice-boxes will be found much better. These should be let into the banks of the channel, and through them the water is run into the furrows, and the quantity of water regulated by a slide. As there are generally a few weeds or a little moss in the water, it is necessary to inspect the slide from time to time, in order to keep them free from any such rubbish, and ensure a regular flow.

A constant watch should be kept on all furrows, to see that the water does not break from same and spread over the land to its detriment.

Another important point, which in this country is very often neglected, is a waste-water drain, so situated that it will catch any surplus water, and deliver it on to some other section of the farm where it can be made use of. It also acts as a surface drain, so that as soon as the soil is thoroughly soaked, all surplus water may be turned into the drain, and not allowed to stand on the soil or crops, as is so often the case. Such stagnant water is very frequently the cause of trees, crops, or vines dying out in a most mysterious manner. In fact, I consider many of the reported failures at the different

Mr. J. Boyd's Vineyard on Wentworth Irrigation Area.

artesian bores are traceable to this, the use of too much water, and lack of cultivation and surface drainage rather than to any other of the many causes brought forward at times by those who claim that artesian water is not suitable for irrigation.

Lucerne is usually flooded by turning large heads of water into the block along the highest side, until it is thoroughly soaked, when any standing water is drawn off, to avoid damage to the plants. Blocks may be of any size from ½ to 10 acres. Around each block there is a bank thrown up to a sufficient height to keep the water within the block. The sides of the bank to have a gradual slope, so that machines, wagons, and carts may be driven over easily during harvesting operations.

Before sowing lucerne seed the land should be watered if it is dry, then ploughed to a good depth, and if it has been well worked up and levelled before the last irrigation, it should be harrowed, and rolled with a light roller, and then the seed sown in drills 9 inches apart, using from 10 to 12 lb. of the best seed obtainable, to the acre. If the work is properly done the seed will come up well and will not require a further watering until it is several inches high. A good time for sowing is in the early fall some time early in March, or if sown in the spring, September or October are good months. After the seed is well up, a light harrowing would be found beneficial. As soon as the lucerne is from 10 to 12 inches high, it is well to cut it and allow the hay to remain on the ground as a protection to the young plants. Cutting has the effect of making lucerne stool out and thicken up so as to cover the ground. The lucerne should be given a thorough watering just before cutting

A 7-year old Orange Tree growing at Pera Bore, and watered with artesian water.

so that it will make a strong growth afterwards. Best results are obtained if the crop receives a thorough soaking every month through the six hottest months.

Planting Trees and Vines.

The land should be properly levelled preparatory to planting. If it is damp the trees may be planted without running the water down a furrow between the double stakes ; but should the planting be done when the ground is dry, it is best to soak the latter before planting. Again, as soon as the trees are planted, the sooner the water reaches the newly-planted tree the better are its chances for making a strong start. As soon as the ground is dry, all young trees and vines should be well worked around with a fork hoe and the soil between the rows worked to a fine tilth. Should the weather continue hot and dry, a second irrigation should be given within three weeks from date of planting—if they are citrus trees. Deciduous trees or vines would not require water so quickly, but if the young plants do not start readily watering must not be neglected, as there is nothing like plenty of water for newly-planted trees. After once the trees and vines are well established less water may be used but plenty of cultivation, the latter being of as much if not of more importance than the former.

A Date Palm growing at Pera Bore, and watered with artesian water.

After the first year or two deciduous trees should not require more than two or three irrigations during the summer, but they require plenty of cultivation from the early spring throughout the summer.

Citrus orchards usually require more irrigations than deciduous, but the trees should not be kept growing too late into the fall else the growth will be tender, and should frosts start early the trees and fruit are liable to be badly frozen. It will also be found that citrus fruit taken from trees irrigated late will not keep as well as fruit from trees which have not been over irrigated or watered late.

If vines are well watered in the winter they will not require so many summer waterings, but the ground must be cultivated deep and often. Avoid irrigating when grapes are flowering and setting.

Potatoes.

Work the land up well, and if it be dry, irrigate just before ploughing. Plough deeply as soon as the land is dry, and plant immediately. Keep the ground well harrowed until the young plants are well up. One good irrigation, or at the most two, are all that is required for spring crops, and these should be given before the young potatoes are any size, as later watering will induce a second growth, which spoils the tubers.

The secret in potato growing is good cultivation, combined with as little water as is necessary to keep the plants in good growing condition.

The spring crop should be planted as soon as the severe frosts are over, which is usually towards the end of August and the fall crop in February. They should be planted in drills 3 feet apart, and when it is found necessary to irrigate, furrows may be drawn midway between the rows and water allowed to run until the ground is well soaked. As before stated, two waterings with good cultivation should be sufficient for any spring crop of potatoes. The fall crop will naturally require one or two more waterings than the spring crop, as the ground is dryer at that time of the year and the heat more intense.

Peas.

These may be sown in drills in moist soil. If sown during hot weather they will require more frequent irrigations and cultivation than during the cooler months. They should be irrigated by drawing a furrow between each row of peas and running the water down same. Drills should be about the same distance apart as for potatoes.

Corn (Maize).

The drills should be 4 feet apart. If the ground is dry, furrows should be drawn and water run along previous to planting; the seed is then dropped into these drills, and covered by a light furrow, after which the ground should receive a thorough cultivation. Future watering should be made through furrows drawn between the rows. This crop is usually raised as green feed for milking cows, or for ensilage, as under irrigation very heavy crops can be produced.

Grain.

Unless the ground is moist, it is best to thoroughly saturate it with water, and as soon as it is dry enough it should receive a good deep ploughing and harrowing, and the seed should be drilled in from day to day, as the ploughing, &c., proceeds, when the grain will soon make its appearance above ground. By working the ground as above it holds the moisture much better than it would if the land were ploughed while dry, and the seed sown and watered to cause germination, which latter process tends to set the soil which would require a second irrigation long before that which had received the watering before ploughing.

At time of harvesting, it will be found that the heaviest yield will come from that portion which had been watered before being sown, and the writer's experience has been that the one crop was much heavier than the other.

When seed is sown in moist soil the latter usually requires no irrigation for two or three months, during which time the grain will make a good growth and send its roots down deeper than into a soil which had received an irrigation directly it was sown. By the time the moisture stored in the ground before sowing has evaporated, the grain will have made a good growth, therefore, when water is applied evaporation from the soil is not so great as it would be from crops irrigated at an earlier stage. Hence the soil of such fields remains in much better condition than that in those irrigated directly after seeding, and the grain has an opportunity of making a correspondingly better growth, and in consequence gives a greater yield. Immediately after sowing, furrows should be drawn at distances of from 3 to 4 feet apart for future waterings.

Sorghum.

The seed is sown on deeply worked moist soil and furrows made at distances of from 3 to 4 feet apart through which to run the water for future irrigations. Good crops of this fodder-plant can be grown on fairly heavy soil.

Many other crops, such as pumpkins, cabbages, cauliflowers, squashes, onions, watermelons, tomatoes, strawberries, and all other garden vegetables, can be grown with very little trouble.

Where trees, vines, or other fruits and vegetables are grown under irrigation, care should be taken to see that water does not flow over the surface of the soil about the trees or plants, and after each irrigation the cultivator is brought into requisition, and the fork hoe, for loosening up the soil close to either trees or plants.

The illustrations used in this article are from photographs taken at various times in different parts of the State, from the dry interior of the Darling to the banks of the Nepean in the coastal district.

Notes on Fowl-Tick and Poultry.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

It is some years since the fowl-tick was discovered and reported as a well-established pest in New South Wales (*Agricultural Gazette*, 1896). Since then it has extended its range all over the south-western towns, and is also common in all the Victorian towns along the Murray Valley as far as Benalla. Broadly speaking, the district infested in the State includes the whole of Riverina, up north and west as far as Bourke, and coming towards the east reaches as far as Wellington, Dubbo, and Wagga.

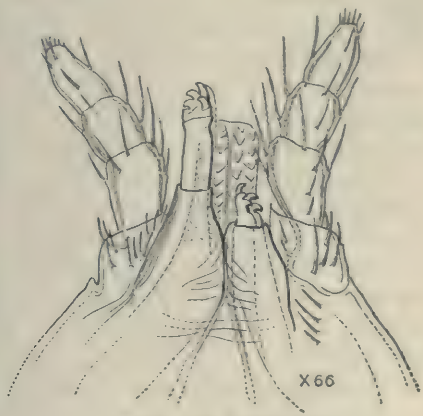
The fowl-tick is said to have originally come from America to Mildura on the Murray, and gradually spread up the river in poultry crates and packages. The habits of these pests were noted in my paper in the *Agricultural Gazette*, November, 1901, but as a good deal of fresh information has since come to hand, I propose to bring it up to date.

The fowl-tick, *Argas americanus*, was originally described from Texas by Dr. Packard; specimens from Australia sent by me to Neumann in France, were determined as this species, while others collected and forwarded by Lounsbury from South Africa, were said by the same authority to be *Argas persicus*, which is a native of Asia. The specific differences are of no particular importance to the poultry farmer, when the habits and results from the infestation are exactly the same. According to Lounsbury's report ("Fowl-tick: Studies on its Life, Cycle, and Habits") reprinted from the *Agricultural Journal* of South Africa, September, 1903, this pest is found in nearly all the towns in Cape Colony, is established in Orange River, Transvaal, and Natal, living and thriving in the coastal towns as well as inland. It is well known in Persia and India, recorded from Algeria and Russia, common in the southern and western States of North America, and the drier portions of South America. In Australia, it is plentiful in Victoria and New South Wales, but its range is limited to the dry inland districts. It was recorded from South Australia by Crawford as far back as 1887, so that there is hardly any doubt that it has spread up the Murray into the towns along the rivers in the first instance.

Considering the length of time that the fowl-tick has been living in Australia, it is remarkable that it has not spread all over the country, for as far as this State is concerned there has been nothing done to isolate or check the introduction of infested poultry or crates into the clean districts. Under the existing state of affairs it has every chance of being introduced from the west or south into the heart of Sydney, and then good-bye to the industry that our prize poultry-breeders have built up in New South Wales. The fowl-tick in its adult form is a dark reddish-brown creature of an oval

Piece of old splintered wood, infested with Fowl Tick.

form, with the back flattened and slightly roughened; the head is hidden under the body and the tips of the four pairs of legs extend beyond the rim of the body when moving about. They have very similar habits to the bed-bug; for during the day they hide in cracks or crevices between the boards, or perches in the fowl-houses; creeping out at night they attach themselves to the fowls and suck their fill of blood, afterwards crawling back to their hiding places, so that the large ticks are never seen on the poultry in the day time.



Mouth parts of Fowl Tick.

The larval ticks, which hatch out early in September (when they can be found under every bit of bark and wood about the fowl-houses), are greyish-brown, with three pairs of long legs, and are not unlike tiny spiders. It is in this stage that they do the most serious damage, for within a few weeks after birth they find their way out and get into the birds, and bury the mouth parts (which at this stage of growth project in front of the thorax and are not hidden as in the adult stage) in the skin and gorge themselves with blood until they become dull purplish black, and measure about one-tenth of an inch in length, the body being swollen and rounded. Lounsbury found that most of them were full fed on the fifth day and ready to drop off, but others, perhaps not so favourably situated on the body for obtaining their food, remained attached up to ten days. A few hours before parting with its host it undergoes a remarkable change; the body alters in shape to the flattened disc of the adult form, and so is more adapted for the life it now leads—hidden in cracks or crevices of the fowl-house and nesting-boxes. Here it rests, assimilating the blood it has gorged from the fowl, and casts its larval skin, appearing now with four pairs of legs and the breathing spiracles of the adult. Within a few days of this change, the young tick comes out and hunts for food, and if successful attaches itself to the bird and feeds upon its blood, but it always leaves its host before daylight, and hurries back to a hiding place. In about a fortnight the tick again casts its skin and appears in a fresh suit of clothes. After this moult the tick again forages round for blood, and again it retires to its hiding place, where in a few weeks it moults for the third time and appears a fully-developed fowl-tick. These mate, and the female lays its eggs in cracks and hiding places; they feed in the adult state during the summer time every month, the female after each feed laying a batch of eggs. As the winter comes round they become more torpid, and later in the season do not feed at all. The fowl-tick has come to stay, and the sooner we realise the fact and set to work to confine it to its present range, and then attack it in the infested towns the better it will be for the State. The backyard fowl-house of the ordinary householder who keeps a few chickens on the scraps, is admirably adapted for breeding ticks, as it is usually built of old packing-cases, rough pine saplings, and sheltered with worn-out corn sacks, for anything is good enough for a fowl-house. It generally rests against a paling fence with a few pepper-trees round about, in which the majority of the fowls roost in preference to their proper house. In many places there is no fowl-house, the fowls roosting on the trees or under the cart-shed, so that in a very short time ticks are carried all over the place. At Moama, I examined an old disused baker's cart under a shed in a yard, where the owner assured me there was no tick in the place, and found, on lifting up the zinc top, that between it and the wood there was a solid mass of adult ticks, from which I could have easily scraped out a couple of quarts in a few minutes. The pepper-trees, on account of their hardy nature, are largely grown in the west, and their rough resinous bark does not retain any moisture but throws the rain off, a condition that just suits the ticks, for they cannot stand water, and are seldom found on exposed walls; but wherever there are dry, sheltering, dark, crevices they congregate, and though they have no eyes they are very sensitive to light, as soon as they are exposed they crawl off under shelter. They are also endowed with a wonderful instinct for finding out fowls, though many probably go hungry for a considerable time where fowls are not numerous. Here again their powers of fasting come into play and make them a difficult foe to deal with, for they can remain shut up in a tin for nearly two years without anything to eat, and timber, fences, trees, or old disused fowl runs may be abandoned and lie idle for a year or two, but a few ticks will survive to visit poultry when they arrive. In my former notes I had no record of fowl-ticks attacking turkeys or ducks, but I now find that both ducks and turkeys soon become infested, and die if brought into tick-infested premises in the summer.

There are hundreds of places where it is impossible to rear any young chickens or fowls, and if fowls are brought into the town yards from farms still free from ticks they will die within a week or two. The few old fowls that have been bled season after season and dipped in sheep-wash or other compounds, become immune or hardened to ticks, and then can live through everything. The method of spreading tick is not so much to be feared from the introduction of strange fowls into the clean yards, as from the old crates, boxes, and bags that may be full of tick, and still not be noticeable. The railway authorities might easily get their crates infested and carry tick all over the State, for they bring quantities of poultry at Christmas from the infested districts.

In Victoria strict measures have been taken to deal with fowl-tick, and poultry introduced from New South Wales, or other States, in which fowl-tick is known to exist, have to be accompanied by a certificate of the Entomologist or Inspectors that they have been passed as free from fowl-tick. They have now taken steps to check its spread in their own towns, and all poultry from an infested district are examined and taken to the railway station, where they are placed in crates that have been specially sent up by the buyers, and have not been removed from the station. Inspectors from the Department of Agriculture have visited Benalla and Echuca, and gone over the fowl-houses with the police-sergeant (who is appointed an inspector under the Act), and condemned every building in which he has found tick, giving the occupier fourteen days in which to pull down and rebuild the fowl-house, coat the timber with tar, remove all the palings in the fence and treat them in the same manner before they are replaced; all pepper-trees are tarred up to 6 or 8 feet, and the tops cut off, so that an inspected town where ticks are rampant in Victoria puts on a half-mourning tint. Special kinds of perches are advocated for placing in the reconstructed fowl-houses, so that tick cannot get on the birds when roosting at night. The uprights of these perches are made of gas-pipe driven into the ground; they have a funnel of tin soldered round the centre below the crossbar perch, in which oil or carbolic wash is placed; planed hardwood perches, laid crossways, rest on four gas-pipe corners protected in this manner.

Swinging perches are used in many places, slung on wires from the roof; these are greased to keep the ticks from crawling down to the perches.

The question of dealing with the tick in this State must be faced, if our poultry-breeders are to hold the place they have done for so many years in Australia; and the first thing that should be done is a strict quarantine, not only of the fowls in all infested areas, but of all boxes, crates, and bags in the neighbourhood; like the codlin-moth with second-hand fruit cases, the fowl-ticks' means of progression and extension is in crates, boxes, and bags from infested yards and not so much on the fowls. If such a quarantine be enforced, the *bonâ fide* poultry-keepers would soon see the advantage of getting rid of, or reducing the tick in their towns, and people would have to get rid of their fowls, or house them properly; but as long as we have no regulations to deal with the matter, hotels, stores, or residences in a country town will have a few fowls running in the yard, laying in the stable and roosting in the cart-shed, so that the whole of the woodwork round the place becomes tick-infested. Where such a state of things exists, there is no reason why fowl-tick should not adapt itself to new surroundings, and invade the dwelling-house and get into the baby's cradle. There was, no doubt, a time when the bed-bug of infamous habits, was a dweller in the forests hiding under the loose bark on the tree-trunks, when it had not learnt the comfort of sheltered beds, or the advantage of living near its food supply, but it is a domestic insect now.

As I noted in my former paper, there is nothing like coal-tar to fill up the cracks in wood used for building fowl-houses; and if all material is well tarred before it is used, and the whole building treated with the same material after it is built, there will not be many holes or corners for the ticks to hide in. Whitewash or lime is all very well, but when it sets it cracks, revealing cavities into which it has not penetrated, very suitable for the home of the wandering tick.

The less wood used in building a fowl-house the better, for in most parts of Australia as long as the birds are protected from the rain and wind, they do not suffer much from cold. The idea that when the ticks are found in the place it can be closed, or pulled down, or even burnt, and the ticks so got rid of, is erroneous, if the fowls are allowed to roost in the trees, for with all rough-barked trees like the pepper-tree, as I have shown, the ticks are just as well covered as in the abandoned fowl-house, and the fowls will still suffer from their attacks.

There is something also to be said about the keeping of poultry in the back yards of the city of Sydney and its suburbs, and it would be of great advantage to the health of the community if the Inspector of Nuisances was empowered to act as a poultry inspector, and the habit of building a chicken-house within a few feet of your own or your neighbour's dwelling-house, discouraged. Even with ordinary care, in midsummer, there is a danger of wind or flies communicating disease from sick fowls or the more or less decomposed scraps fed to the poultry, for the ordinary householder only "keeps a few fowls to eat up the waste scraps." How much more so where a number of unfortunate fowls, crowded up in a few square yards of wire-netting, are cleaned up at irregular intervals. There was a time, not so long ago, when the homely pig, with his backyard sty, was quite a common object in the suburbs, but at the present time who would let his neighbour keep a pig close to his house?

Before the outbreak of plague in Sydney, I am told, on good authority, that there were quite a number of small shopkeepers in the streets of Sydney who kept a few "chookies" in the cellar and basement.

The Application of Science and of Scientific Method to Agriculture.

F. B. GUTHRIE.

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Agriculture depends more directly for its progress upon the development of science than is the case with any other material art. The rapid advances made in farm-practice within recent years have been coincident with the advance of scientific knowledge, and the application of scientific facts and methods to agricultural pursuits. The day of the rule-of-thumb farmer, nourished on tradition and adopting methods handed down through the generations, is past. In order to hold his own among his competitors, the farmer of to-day cannot afford to neglect the teachings of science as far as they affect his own pursuits, and that farmer will be the successful one who is able to understand what science has to tell him, and to utilise the weapons which she places in his hands.

By this, I must not be understood as intending to imply that the farmer must be a man of science—an entomologist, a botanist, a chemist, and so forth—but I do mean that he should have an education of sufficient scope to enable him to make use of results obtained by scientific men, and to conduct his own work in the scientific spirit. For it is not only by the direct application of scientific facts that science benefits the farmer, but in a still greater degree by the application of the scientific method to farm-work; the spirit of inquiry and observation, the patient, accurate, and systematic attention to details, and, above all, in the continual use of experiment. Without this, the farmer becomes a mere sowing and reaping machine, incapable of progress, and at the mercy of adverse seasons and of more energetic competitors.

Amongst ancient peoples, and until quite recent times, agriculture was purely an empirical art; the operations of the farm were handed down as traditions from father to son, and no attempt was made to understand the principles underlying such operations.

The earliest peoples were acquainted with many of the operations which form the basis of successful farming to-day. The Egyptians knew the value of many substances as fertilisers, and were in the habit of improving barren soils by the admixture with them of more fertile ones. The value of bare-fallow and of the rotation of crops were known in very early times, but no attempt was made to explain the rationale of such operations, and to apply them systematically, until quite modern times. Indeed, this is hardly a matter for surprise, since the principles involved could not possibly be understood until the sciences of chemistry, plant-physiology, bacteriology, &c., had advanced sufficiently to provide some kind of interpretation.

The first to establish the fundamental fact that the saline constituents of the soil constitute the nourishment of plants was Bernard Palissy, the Perigord potter. His long and arduous search for the particular saline glaze of which he was in need, led him to study more particularly the characteristics of the salts met with in the different earths, and he made the observation that the growth of plants abstracted certain salts from the soil, and that the efficiency of substances used as manure at that time, such as marl, was due to their containing certain soluble saline matters; and that the cause of the well-known fact that continual cropping exhausted the soil was the removal of the soluble salts. These are, in fact, the principles upon which our modern system of manuring is based.

General interest in the connection between science and agriculture was first awakened in France by the celebrated chemist Réaumur, who published in 1730 a treatise discussing the factors which induce fertility in different soils. Réaumur enjoyed a high reputation on account of his work in other branches of applied chemistry, notably pottery and the metallurgy of iron and steel, and his work aroused universal interest. In France several of the academies offered prizes about this time for essays dealing with the subject, and with the kindred one of the improvement of soils by admixture with other soils. Amongst the institutions which were the first to encourage in this manner the study of scientific agriculture were the Bordeaux University and the University of Montpellier. It is thus to France that the world owes the first systematic endeavour to apply scientific methods to the improvement of the soil and for the benefit of the farmer.

The position of scientific agriculture at this time and till the close of the eighteenth century is practically confined to the study of the constituents of the plants and a comparison of the constituents of the soil upon which they grew, the basis of investigation being the assumption that the plant grows by the absorption of certain saline substances from the soil.

The closing years of the eighteenth century were illumined by the startling discoveries of Priestley, Cavendish, and Scheele, and the brilliant generalisations of Lavoisier, which established chemistry as a science. In common with other branches of applied chemistry, agricultural chemistry assumed a new complexion. The names of those who took up the study of the growth and requirements of plants in the light of the new knowledge were numerous, and included some of the foremost men of science of the day.

Priestley himself, the discoverer of oxygen, was the first to identify as oxygen the bubbles of gas which are given off when green leaves are enclosed in water in a flask and exposed to sunlight. This is a phenomenon of great importance in plant life. He also observed the fact that growing plants have the power of purifying vitiated air, making it richer in oxygen.

We owe our knowledge of the rationale of this process by which the green-colouring matter of plants decomposes the carbonic acid of the air under the influence of sunlight to Jungenhousz and Sénébier. The former showed that the reaction only occurred in sunlight, and Sénébier showed that it was the decomposition of the carbonic acid which yielded oxygen, the carbon being absorbed by the plant to build up its tissues.

Alexander von Humboldt was the first to make careful and complete examinations of atmospheric air, and we owe to him our first knowledge as to the part played by its different constituents other than carbonic acid in the maintenance of plant life. So that De Saussure, in his "Recherches Chimiques sur la Vegetation," 1804, was able to state with some definiteness the sources of the various components of the plant. The carbon is obtained in the manner above described, the hydrogen and oxygen from water, and the mineral constituents from the soil.

But of all the chemists whose work was done at the beginning of the nineteenth century, none advanced the science of agriculture to the extent that Sir Humphrey Davy did. His work in connection with agriculture is quite overshadowed by his remarkable discoveries in other branches of chemistry. It marked, however, a distinct epoch, and he made agricultural chemistry a popular subject by a series of lectures on the subject. These lectures were published in 1813 under the title, "Elements of Agricultural Chemistry," which were regarded for many years as authoritative, and afford us an indication of the state of the science until the general adoption of Liebig's views. Davy was the first to undertake exact and exhaustive analyses of soils, and recognised the importance of maintaining a proper proportion amongst the various ingredients of which the soil is composed. Sand, clay, humus must all be present in fertile soils. He noted also the great importance of the power of absorbing and retaining water in relation to soil fertility. According to Davy's teaching, plants obtain their food from water and humus alone; water and humus containing all the fertilising substances necessary to support plant-life. Davy dismisses the subject of the manurial value of saline substances with the statement that as none of them provide the plant with any of the "common principles of vegetation," namely, carbon, hydrogen, and oxygen, they need never be employed, except such of them as contain carbonates, ammonium salts, or nitrates. In Davy's analyses of soils, therefore, ingredients such as phosphates, potash, and nitrogen, which we now recognise as of special importance, were not even determined.

The next notable worker in the field of scientific agriculture was the French chemist Boussingault, who was a co-worker with his yet more distinguished fellow-countryman, Dumas, in the domain of physiology, and whose researches have laid the foundation of our knowledge concerning the processes involved in the nourishment of animals and of plants, the forms in which plants obtain their nourishment, and nature of the plant-ingredients which are utilised in the feeding of animals. But Boussingault has a still more particular claim to the gratitude of those who derive their living from the soil. He was the first to institute experimental methods of research in actual farm practice. He fitted up a laboratory on his farm at Bechelbronn, in Alsace, and was the first to carry out farm operations in the field with some approach to the exactness of scientific investigations. He realised fully, the value of experiment stations established in connection with the farm, and has the merit of having founded the first of these invaluable institutions, the spread of which has been the most important factor in modern agricultural progress. Of all the benefits which agriculture owes to science, none, I think, can compare in importance with the work of these stations, the value of which is recognised in all countries of the world. For it is here that any new theories are put to the test, and suggestions as to treatment of soil or crop can here be carried out under the most favourable conditions, and their value or uselessness ascertained. More important than all for the progress of agriculture, the farmer and the scientist can here meet on common ground, and such farms have done more than anything to do away with the prejudice that used to exist, and unfortunately still does exist here and there, against the scientific worker. The results of the experiments are here exhibited plainly in the field, open for inspection and criticism; and the farmer receives clear and ocular demonstration of the result of the comparison of different crops, different systems of soil,—treatment, of rotation, of manuring, of pruning, and spraying, &c. Boussingault has the honour of having instituted the first experiment station in 1834, and he continued to enrich the science by means of experimental work until his death in 1887. He was the first to establish the scientific principles underlying the rotation of crops; he studied the effect upon production, of draining, clearing, and other operations, the question of the nitrogen-supply of plants, vine-culture, &c.

In the year 1840, the great German chemist, Liebig, published his book entitled "Chemistry in its application to Agriculture and Physiology." This publication, followed in 1859 by the same author's "Letters on Theoretical and Practical Agriculture," may be regarded as the foundation of modern agricultural science,—at least agricultural chemistry. Though much of his teaching requires to be modified in the light of more recent research, the fundamental principles laid down by him are still accepted as correct. Briefly, his teaching may be summed up as follows:—A fertile soil is one that contains all the elements of plant-food in an available form. Each crop removes a portion of these ingredients. Some are replaced by the air and water. Some are lost if not replaced by man, in the form of manure. To maintain fertility, *all* these substances must be replaced. Farm-yard manure does not replace the whole of the substance removed; some in the form of grain, hay, milk, live stock, &c., being entirely lost. He combated the view previously held as to humus being the only source of plant-food, and taught that water, carbonic acid and ammonia, derived from air, are the essentials necessary for the growth of plants. These are supplemented by salts supplied to the plant in aqueous solution by the soil. Plants can be grown in the total absence of humus, and require only air and water holding certain salts in solution. He recognised in particular the importance of phosphates in the nourishment of crops, and we owe to him the important discovery that when bones or mineral phosphates are treated with sulphuric acid (that is, converted into superphosphate), the phosphoric acid is now in a form in which it is absorbed with great readiness by plants. This discovery entirely revolutionised the prevalent methods of manuring, and created a new and important industry, which has to-day become one of the largest of the branches of applied chemistry, namely, the manufacture of artificial fertilisers, with superphosphate as a basis. Liebig was, at the time of the publication of his work, the leading scientific authority in Europe, and his views commanded immediate and universal attention. In Germany, the Government recognised at once the importance of extending assistance to the study of scientific agriculture. Courses were instituted at several of the Universities, and State experiment stations founded where field experiments could be carried out under ordinary farm conditions. Other countries quickly followed the good example they set, and agricultural colleges and experiment farms sprang up everywhere. It is to the universal spread of these institutions that we owe the enormous improvement in agricultural practices.

The history of modern progress in agriculture is contained in the records of the public and private experiment farm and stations, principally in Germany, France, England, and the United States of America. In the United States particularly, the authorities have been quick to realise the importance to the farmer of scientific aid. Since 1875, when the first of these institutions was founded under the Hatch Act, they have multiplied with great rapidity, and there are now over fifty experiment stations whose work is exclusively devoted to scientific research work in agriculture, and over fifty Universities and colleges having courses in agriculture provided in their curricula, a considerable number of which are colleges devoted exclusively to agriculture. In many cases the college and the experiment station are the same institution, several of the colleges (Amherst, for instance) having experiment stations attached. It is impossible to avoid the reflection that the enormous growth of these institutions in America, and the important part played by the Department of Agriculture in that country, is a matter that merits our serious consideration. The Americans have a tolerable reputation for shrewdness, both in their private and national undertakings, and it is not easy to believe that they would continue to expend money on institutions that did not pay, or in pursuit of a policy that "cuts no ice."

Of the private institutions of this nature, none has done more for agricultural progress nor enjoyed a more deserved reputation than the Rothamstead Experiment Station, founded by Sir John Lawes. The Rothamstead Station may be said to date from 1843, when Sir John Lawes associated with himself the distinguished chemist, Sir John Gilbert. Sir John Lawes had been working by himself for about ten years previously, and it is thus only a very little, if at all, younger than Boussingault's station, but it has far surpassed the older one in the value of the work done and the length of time over which its operations have extended. Sir John Lawes has bequeathed Rothamstead to the nation to be managed by trustees, and has endowed it with the sum of £100,000. The Rothamstead experiments will remain for all time a model for the conduct of such work, and include field investigation as to the efficacy of different manures and methods of soil-treatment, rotation of crops, feeding of animals, fixation of nitrogen, and, in fact, experiments of all kinds calculated to result in improved methods of farming.

In the foregoing brief summary of the progress of scientific agriculture, I have confined myself to the main lines of investigations, developed by different workers up to the time when agriculture ceased to be empiric, and was founded by Liebig on definite scientific principles. In those days the only science that was of much assistance to agriculture was chemistry, and it still remains the most important one to the farmer, both because of the light which it can throw upon the principles underlying farm-practice, and because of the humbler service which the analyst performs in the analysis of fertilisers, soils, and farm produce generally. It has not been with the idea of magnifying the chemist's contributions that I have laid so much stress hitherto upon the chemical questions, but simply because in the historical development of the subject the fundamental questions were the first to be discussed, and these are chemical ones.

Fixation of Nitrogen, &c.

Among special questions the study of which has resulted in most important advantages to the growth of agriculture is that of the plant's supply of nitrogen. We owe the solution of this question to the science of bacteriology. It had long been known that the addition to sterile soils of relatively small quantities of other soils was capable of rendering the former fertile. This was found to be accompanied by an increase in the amount of nitrate (salts of nitric acid). The discovery by Pasteur of organisms inducing different kinds of fermentation showed the way to a rational understanding of this phenomenon. Pasteur himself surmised that this gain in nitrates was brought about by the development of micro-organisms. In 1878 Schloesing and Müntz in France were able to prove that this was the case, and that certain nitrifying organisms were capable of converting ammonium salts in the soil into nitrates. These organisms were isolated by Winogradsky, who separated two distinct groups, one of which converts the ammonium compounds into nitrites, while the second carries the oxidation a stage further, and produces nitrates.

The question whether plants are able to absorb the nitrogen of the air directly by means of their leaves was, for a long time, a vexed one, and nearly every investigator of distinction gave his attention to this subject. The question can hardly be said to be definitely cleared up to-day, but the theory now accepted is that plants do not absorb nitrogen by means of their leaves, but that one class of plants, the leguminosæ, have the power of assimilating, by means of their roots, the free nitrogen contained in the interstitial air within the soil. The German chemists, Hellriegrel and Willfarth, were the first to establish this highly interesting and important fact, and they proved that true assimilation was effected by the agency of bacteria inhabiting the root nodules of leguminous plants, such as clovers, peas, &c.

These investigations have not only been of the very greatest value in enabling us to understand the principles underlying such operations as the rotation of crops, and to place them upon a systematic basis, but they bid fair to indicate a means of directly increasing the fertility of the soil by the direct application of the organisms involved.

Many attempts have been made to prepare pure cultures of some of these nitrifying organisms, and to inoculate the soil with them. The most successful attempts have been with the root-nodules of leguminous plants. Professor Nobbe, of Saxony, prepared cultures of these bacteria, which were and are still on the market under the name of "Nitragin." These have been used often with success for inoculating soil on which the host plants did not make good growth. More recently Dr. Moore, of the United States Department, has prepared, by a somewhat different process, cultures of these organisms, which it is claimed have produced the most remarkable results in farm practice. It is yet rather early to pronounce on the success or non-success of these cultures. They are being experimented with, probably, by every agricultural department or station in the world.

The free nitrogen of the air can then be utilised directly by certain plants in the manner mentioned. The majority of cultivated plants, however, derive their nitrogen from nitrates and ammonium salts in the soil. A point of the very greatest importance to us is—can we by any means reproduce artificially this nitrogen absorption? Can we convert atmospheric nitrogen into a form in which it can be absorbed by the plant? The importance of this question is enormous, for nitrogen is one of the substances which is absolutely essential to plant growth, and is one which most crops (legumes excepted) have a difficulty in utilising in the form in which it is present in the soil. It is, therefore, continually applied in manure. Substances like stable manure, blood, bone-dust, sulphate of ammonia, and nitrate of soda, owe their efficiency to the nitrogen they contain. But nitrogen is a very difficult substance to catch and force into combination with other elements. In the air, as you know, it exists in the free state, and it is characterised by a highly aristocratic exclusiveness, a strong disinclination to mix with socially inferior elements, a characteristic which is so marked that even when it has been coaxed into combination—such, for example, as nitro-glycerine, nitro-cellulose, picric acid, &c., it liberates itself on the slightest provocation with violent explosion. On account of this aloofness it has not yet been possible to devise a means by which atmospheric nitrogen can be made to combine readily and cheaply in such a form as to be available for plant-food when applied to the soil.

Recently, however, what looks like a possible solution of the question has been discovered. When air, from which the oxygen has been removed, and which may be regarded as practically pure nitrogen, is passed over calcium carbide at a white heat, it combines, forming a compound known as calcium cyanide. This is a fine black powder which is decomposed by water into ammonia.

The crude cyanide has been found to possess manurial value, due, no doubt, to the liberation of ammonia by the soil-moisture. Too few experiments have as yet been tried with this substance to settle the point as to whether it is likely to be an effective substitute for sulphate of ammonia.

Dr. Hall, of the Rothamstead station, has reported a trial with mangels, swedes, and mustard. He reports that the trials do not warrant any definite conclusion as to its comparison with sulphate of ammonia, for example, but finds it to be an effective nitrogenous manure. But even if we have not yet got the desired substance, there is little room for doubt that experiments along this line will result in the preparation of a cheap fertiliser from the practically limitless expanse of air. English people will be pleased to hear that there is already a company, connected with the Cyanid Gesellschaft in Berlin, where this substance is being prepared—at present, only at the rate of about one ton per day.

Another method by which attempts are being made to obtain a cheap supply of nitrate from the air is by means of electricity. As you are aware, when air is "sparked," nitric acid is formed by the direct union of the nitrogen and oxygen. This happens always in the neighbourhood of electrical machines, and during storms the flashes of lightning cause this combination; so that the air during a thunderstorm always contains small quantities of nitric acid. Attempts are being made to utilise this action on the manufacturing scale, converting the nitric acid so formed into nitrate of soda.

The solution of this problem is simply a question of cheapening the unit-cost of the electric current. Sir William Crookes has calculated that if the cost could be reduced to $\frac{1}{17}$d. per Board of Trade unit, which is quite possible when large natural sources of power like Niagara are used, the cost of nitrate of soda need not be more than £5 per ton. Up to now it has not been possible to manufacture "electric nitrate" at a rate to compete with the natural nitrate of soda.

Another highly interesting application of electricity to agriculture lies in the possibility of inducing the growth of crops by the direct electrification of the soil or of the air. Professor Lendstrom has published some exceedingly interesting experiments which he has made in this direction, and which point conclusively to the fact that plants growing on an area artificially electrified attain more vigorous growth than in the case of plants not so treated.

Implements.

Improvements in the implements used on the farm have been, of course, directly due to the advance of scientific knowledge. The replacement of the wooden implements used by the earlier nations by implements of iron the use of steel, and the introduction of steam and electricity as motive-powers, mark the main epochs of improvement in this respect. The plough, to take an example, although not differing in its essentials in its modern form from that used by primitive peoples, has undergone many improvements in its constituents, partly due to the introduction of steel, and of increased mechanical knowledge, partly, on the other hand, due to increased knowledge of the peculiarities of the soil, and the functions which can be performed by the plough. Share, mouldboard, coulter, have all undergone modifications, and, recently, the type of mouldboard plough has been, in some instances, replaced by the disc plough, provided with revolving discs. The subsoil plough is also an introduction of recent times. This plough is provided with a share attached to the beam, and set to a lower depth than the ploughshare. This follows behind the plough, and breaks up the smooth-pressed surface left at the bottom of the furrow, thus loosening the earth to a greater depth and enabling the roots of the plant to penetrate further in search of food and moisture.

The introduction of steam, and the advanced application of mechanics, have introduced all kinds of machinery to replace manual labour. Sowing, cultivating, reaping, threshing, winnowing, &c., are now all done by machinery. The increased improvements in machinery and in mechanical contrivances have introduced the possibility of sowing both seed and manure in drills, thus effecting a considerable saving in the quantities used. The advent of the motor is likewise effecting a revolution in farm-practice. Motor-ploughs, motor-harvesters, &c., are coming into use.

Improvement in Plants.

Another direction in which the application of science has enriched agriculture, is in the improvement of farm crops and animals, by selection and by cross-breeding. The present high quality of our staple product, wool, is an instance which is familiar to you. The improvement of the sugar-beet is another instance of an industry, the enormous growth of which is entirely due to the application of science—in this instance, of chemistry. The original of the sugar-beet of to-day—the white Silesian beet—contained about 6 per cent. sugar; the improved varieties at present cultivated have a sugar content of over 20 per cent. In the improvement of the sugar-beet the name of Vilmorin is best known as the originator of the modern varieties. The manufacture of sugar is essentially a chemical process, and the improvement of the beet has been, as I have intimated, entirely due to the application of chemistry. Vilmorin's method of selection consisted in taking, by means of a gouge, a small cylindrical piece from the roots while growing in the ground, and utilising for seed purposes those plants whose roots showed the highest sugar-percentage. We owe to Vilmorin, also, our improved parsnip, carrot, radish, &c., from the wild plants of these varieties.

The improvement of wheat, the staple food-grain of so many countries, has also engaged considerable attention, and whatever permanent success has been achieved has resulted from the application of scientific methods of investigation. Till recently, inquiry was mainly directed towards attaining larger grain and more prolific varieties—qualities which appeal more immediately to the grower.

Messrs. Garton Bros., amongst others, have attained considerable success in this direction. Very notable work has, however, been achieved recently in New South Wales, by one whose name is, no doubt, familiar to you—Mr. Farrer.

Mr. Farrer was the first to approach the subject in the true scientific spirit, and the result is, that while the improved varieties produced by other workers are of more or less local interest only, Mr. Farrer has already achieved notable results, which promise to be of a permanent nature. His objective is only in a minor degree the production of an attractive and prolific grain. The problems set himself are, practically, three in number:—

1. To produce types of grain suitable for the different climates met with in New South Wales—particularly to produce a grain suitable for a dry climate such as we have in the Western Division of the State.
2. The production of a variety which shall resist or escape rust, a disease which causes much damage to our crops year after year.
3. To improve the milling-qualities of our wheats, and to ensure, in the case of all new varieties produced, that they shall be of a high standard for milling.

It is this last aspect which differentiates Mr. Farrer's work from that of others, and gives it its peculiar importance. It has too frequently happened in the past that new and very promising varieties have proved disappointing, because they have gradually deteriorated in their milling qualities, or give flour of poor quality. There is no advantage in increasing the yield per acre if the grain harvested commands a lower price or is unsaleable.

Mr. Farrer, by paying particular attention to this point, has not only succeeded in maintaining a high milling standard in his cross-breeds, but has produced new varieties of much greater value to the miller than any that were previously in cultivation.

The question of the production of a grain that will resist rust is, I believe, satisfactorily solved. The question of a payable wheat for the rainless west cannot yet be said to have been solved, though some of Mr. Farrer's cross-breeds do far better in these districts than those hitherto cultivated. It may be that some of the varieties produced may become acclimatised, or that some as yet unformed variety may be found to satisfy the requirements.

Potatoes.

The potato is another crop which has been subjected to scientific improvement of recent years. Quite recently varieties have been produced which command fabulous prices for seed. As much as £2,000 per ton is paid by the farmer in the assurance of an enormously increased yield of tubers and their higher value on the market.

Vines.

Of similar nature to the question of rust-resisting wheats is that of vines capable of resisting the attacks of the phylloxera. In Europe, not many years ago, enormous areas of vines in Southern Europe were destroyed by this pest, which threatened the wine-production of France and Italy. Here also a remedy was found in a vine which grew in the United States, and was immune from the attacks of the pest—was, in fact, phylloxera-resistant. By grafting the wine-producing grape-vine upon phylloxera-resistant stock, it was found that, while the wine-producing power of the vine was in no way affected, the grafting had imparted to it the power of resisting phylloxera.

We are benefiting from this discovery in New South Wales. As you doubtless know, considerable areas of vineyards were destroyed a few years ago in New South Wales by the phylloxera, or had to be compulsorily destroyed to prevent its spread. These are now all being restocked with phylloxera-resisting vines, a nursery for which is being maintained by the Department at Howlong, under the superintendence of Mr. Blurno.

Fruits.

In the improvements of fruits many triumphs are to be recorded—in the production of more prolific varieties, larger fruits, and in some instances of seedless varieties, as well as in the production of new fruits, as the result of the combination of two different kinds. In this connection, the work of Mr. Luther Burbank has been very prominently mentioned lately, and there is no doubt that some of the results obtained by him are extremely interesting and remarkable.

Insect Pests and Fungus Pests.

In the incessant fight which the farmer has to wage against insect and fungus pests of all kinds he calls in the aid of the sciences of Entomology and Chemistry. In some cases, as in those just mentioned, resistant varieties exist, and by crossing with the susceptible plant immunity can be conferred on the latter. In other cases, the life history of the insect or fungus has to be studied (the province of the entomologist and the vegetable pathologist), and remedies applied which are based on a knowledge of the habits and peculiarities of the pest. In other cases the chemist is called upon for the preparation of insecticides and fungicides—poisonous sprays which act in various ways.

Of recent years, especially for orchard work, fumigation has been largely adopted. This is done by enveloping the affected tree in a tent and liberating prussic acid gas, an extremely powerful poison, within the tent. This is also the best and most approved method for treating fruit affected with scale, especially for export.

Still another method for combating insect and fungus pests is the search for parasites which feed upon the pests, the theory being that by the introduction of a parasite which feeds upon any particular insect, the host will be, if not exterminated, at least kept in check. This method has succeeded admirably in two notable instances—that of the Gypsy Moth and the so-called Cottony-cushion Scale in the United States; and though the matter is one involved in innumerable difficulties, it is not too much to hope that the method may prove successful in some instances, though probably not of universal application.

Feeding of Farm Stock.

The proper feeding of farm stock is another subject to which attention has been paid in recent years. Like the breeding of plants, the art of feeding animals is based on definite scientific principles, and in up-to-date farm management the rations for farm animals are devised and prepared with the same care as is devoted to the manures for crops.

When it is remembered that the food best adapted for any animal varies with the purpose for which it is fed, and with its age, it will be at once realised that there is scope for a very great variation in the rations, and a very careful consideration of the object for which it is given. The food-requirements of a draught ox, a milch cow, and an ox which it is intended to fatten, present features of distinct difference which all have to be taken into careful consideration if the food applied is to be used to the best advantage, most economically, and without waste.

The question is one which cannot be said to have received the consideration in New South Wales which it deserves, the feeding of dairy-cattle being probably the only direction in which it is pursued on anything like scientific lines, although the question of the proper feeding of sheep in times of drought, when artificial feeding has to be resorted to, is one of the greatest importance to pastoralists, and one that consequently assumes national importance.

Even the question of the feeding-value of our different native scrub-plants has only been touched on in a superficial manner.

Dairying.

Of special agricultural industries, dairying has, in particular, been affected by the adoption of scientific methods to an extent that has brought about a complete revolution in the system of dairy-farming, so that the dairy-farmer of twenty years ago would hardly realise for what purpose a modern butter-factory was intended. He would find the place filled with machinery for separating the cream and for handling it and making the butter, with thermometers, test-tubes, and burettes, and all kinds of chemical apparatus, strange-looking bottles with chemical labels, centrifugal machines, pasteurising apparatus, &c.; and he might easily imagine himself to be in the testing-room of an engineering laboratory.

The introduction of the Laval separator first made possible the establishment of co-operative butter factories, and the invention of Dr. Babcock's machine for determining butter-fat in milk and cream made it possible to test rapidly and with certainty a very large number of samples of milk or cream, and determine their fat percentage—an operation that by chemical methods is too technical and slow for factory work. This invention made it possible to purchase milk on its fat content; in other words, to pay only for the cream which it contained, and thus entirely revolutionised butter-making.

Milk being especially favourable to the development of organisms of all kinds, the help of the bacteriologist is of the first importance in devising means both for preventing contamination, and for propagating the particular organisms which impart the required flavour and ripeness to butter and cheese.

Viticulture and Tobacco-curing.

Are also agricultural industries in which the sciences, and particularly bacteriology, play an ever-increasing part.

Apart from the proper soil, treatment for the vine, manuring, &c., the treatment of the must and the manufacture of wine is becoming more scientific and less empirical, according as the nature of the operations involved in wine-making become better known, and viticultural chemistry and bacteriology have become distinct branches of applied science. The use of *levures* or yeasts for the production of desired bouquets or flavours requires skilled bacteriological knowledge.

If I have succeeded in properly presenting my subject to you, you should have realised that science plays an extremely important and continually increasing part in every department of the modern farmer's life, and that its teachings cannot be neglected by the farmer who wishes to succeed. Any State which aims at improving the condition of agriculture within its borders is bound to encourage the dissemination amongst the farmers of the scientific principles underlying farm operations, and to keep them in touch with the latest experimental work, which may have a value to them in improving their farm practice. This can be done by means of colleges and experimental farms, by encouraging farmers to carry out experiments on their own farms, by lectures, and by publication of work done here and abroad, the results of which are of value to the farmer. The enormous advance in agriculture in Germany, Denmark, and the United States, of recent years, has been due less to the fiscal policy of the Government than to the universal dissemination of education, and the application of scientific methods.

Nobody deprecates more than I do the idea of stuffing the farmer with a mass of technicalities which he is unable to understand; but there is a vast difference between this and the opposite policy of withholding from him altogether the results of scientific investigation. My experience of the farmer is that he is a person of some intelligence, and quite capable of rejecting what is of no value to him; but if we propose to assist him in his occupation, we shall achieve that end far more surely by inculcating the scientific spirit of investigation, by giving him and his sons access to colleges and experiment stations where scientific work is being carried on, and by encouraging him to conduct all his own operations in the spirit in which scientific experiments are carried on, than by any amount of legislative enactments in his favour; for, after all,—if I may be permitted to repeat a remark which I have made before on another occasion,—however much legislation may favour or hinder commerce and industry, the commercial or industrial pre-eminence of a country depends finally upon the energy and the intelligence of its people; and it is in the facility given to scientific research, and the diffusion of scientific knowledge, that the real foundation of the future prosperity of a country depends; and this applies with especial force to agriculture, progress in which is, as we have seen, so intimately bound up with scientific progress.

Sheep at Bathurst Experimental Farm.

R. W. PEACOCK.

The experiments in connection with cross-breeding have been continued at this farm throughout the year. The number of sheep at present carried is as under :—

Ewes	264
Rams	6
Wethers	24
Hoggets	98
Lambs	268
Total	660

The lambs marked averaged exactly 100 per cent. As a basis for the experiments, merino ewes were mated with Shropshire, Southdown, Lincoln, Border Leicester, and English Leicester rams. A number of hogget ewes were held over from the previous year of the various crosses, as a basis for further experiments upon the second crosses, the results of which are not yet available.

Of the first crosses, pens of the following were exhibited at the Sheep-breeders' Show, held in Sydney, 1905 :—

		Average live weight. lb.
Lincoln merino wethers	19 months	154
Border Leicester merino wethers	18 ,, ...	144
Shropshire ,, ,, ...	18 ,, ...	142
Southdown ,, ,, ...	18 ,, ...	135
English Leicester ,, ,, ...	18 ,, ...	135
Shropshire ,, lambs	5 ,, ...	82
Border Leicester ,, ,, ...	5 ,, ...	76
Southdown ,, ,, ...	5 ,, ...	74
English Leicester ,, ,, ...	5 ,, ...	70
Lincoln ,, ,, ...	5 ,, ...	67

The autumn was an exceptionally bad one, and it was found that on the short keep the Downs crosses did better than those of the long-wools. If the weights of the lambs are divided by two, a fairly accurate estimate of their dressed weight would be gained, as lambs in fairly good condition lose about 50 per cent. when dressed. The lambs dropped in the spring suffered when being weaned owing to the drought.

The following average weights of the fleeces of the various crosses should prove an index to the values of the crosses as wool-producers. The weights are for the 1905 clip, including the bellies.

			Average. lb. oz.
Merino ewes ...		4 and 5 years ...	8 3
Lincoln-Merino ewes		4-tooth ...	9 10½
Border Leicester—Merino ewes ...		4 ,, ...	9 2
English ,,	,, ,,	4 ,, ...	8 11
Shropshire	,, ,,	4 ,, ...	8 0
Southdown	,, ,,	4 ,, ...	7 8
Lincoln	,, wethers ...	4 ,, ...	12 0
Border Leicester	,, ,,	4 ,, ...	11 12
English ,,	,, ,,	4 ,, ...	10 8
Shropshire	,, ,,	4 ,, ...	10 8
Southdown	,, ,,	4 ,, ...	8 12
Lincoln	,, hoggets ..	12 months ...	8 13½
Shropshire	,, ,,	12 ,, ...	7 12
Border Leicester	,, ,,	12 ,, ...	7 10
English ,,	,, ,,	12 ,, ...	7 7
Southdown	,, ,,	12 ,, ...	6 12

The following is a report upon the 1904 clip, by Mr. Alfred Hawkesworth, and my thanks are due to him for the trouble he took in preparing it:—

"Southdown Stud Ram.—A typical ram's wool of its breed. Whilst showing great quality, there is sufficient robustness most necessary for a sire. There is a uniform length all through, the staple being well formed, free, and compact to the tip. Fibres are perfectly sound, with the correct undulating, wavy formation. For a Downs wool, the texture cannot be improved; and I think, if crossed with good merino ewes, the progeny would give an excellent fleece, both as regards quality and quantity. It is a good yielding wool, fully 62 per cent. when scoured, with a 50's spinning count.

"Merino Stud Ram.—An excellent type of a medium to fine merino wool, very even in length and quality, excepting a small part of the thigh or breech. Staples are free, fairly bold, showing a true merino character from the shoulder to the breech. For breeding purposes, this ram is symmetrical and has a good constitution. There should be good results if mated with suitable ewes. Spinning quality, 70's; clean yield, 44 per cent.

"Merino Ewes.—Many of these fleeces are evidently off ewes that have seen their best days, the growth being stunted, with weak backs, still showing good merino character. Some fleeces are well grown, sound, free, and full of quality from tip to base of staple, denoting good breeding. Although of nice quality, there is a desirable amount of robustness, with a good crimpy formation. Average spinning counts, 64's; yield, 42 per cent.

"Southdown-Merino Half-breds.—These fleeces must be divided into three classes, as there are some really good and some inferior, and I will take those with numbers first so as to serve as a guide. Nos. 80 and 74 can be placed first, and are an excellent type of half-bred wool of this cross, just the sort to take the place of our strong merino wool. There is a good length with a free staple, showing much of the merino character, a very desirable property in cross-bred wools, and which make them of considerable value for manufacturing purposes. Spinning counts, 60's; clean yield, 55 per cent.

"Nos. 75, 77, 83, 81, 78, 79.—These fleeces were of a very useful class, both from a breeders' and manufacturers' point; very little inferior compared compared with Nos. 80 and 74. The difference rests in appearance, the former being superior and these fine. Spinning counts, 56's; clean yield, 55 per cent.

"Nos. 76 and 82.—I would not advise these to be used for breeding purposes, the wool being open, light, straight-fibred, and only fit for low hosiery goods. There is a want of body and style in the wool. Spinning counts, 50's; clean yield, 52 per cent.

"The rest are very useful wools, fitted for the manufacturer, and are better than Nos. 76 and 82. The growth is even, quality good, and fair weights. A sound commercial wool. Spinning counts, 56's; average clean yield, 54 per cent.

"Shropshire Downs Ram.—From the appearance of the fleece, I would say that this ram has seen its best day, as the wool is irregular in growth, the quality varying, back thin and weak, breeches rough and large; the whole fleece being in a hungry condition. Is fit for low hosiery yarns."

[NOTE.—This ram is aged, and a young ram has been purchased to take his place.—R.W.P.]

"Shropshire-Merino Half-breds.—Nos. 12, 68, 71, 69, 70, 67.—These numbers are placed in rotation according to merit, forming a real useful type of wool from both a breeders' and manufacturers' point. There is mostly a good, sound, healthy growth, the staples are of combing length, of nice quality, showing an even crimpy formation. A real good commercial wool. Spinning counts, 54's; average clean yield, 64 per cent.

"Nos. 66, 1, 64, 65.—Taking these wools as a guide, I would not advise the sheep to be used for breeding, that is if good progeny is expected. The wool is mostly thin, light, and does not show much breeding. This class of wool is not of that stamp a farmer requires, and can only be grown at a loss. Spinning counts, 50's; clean yield, 57 per cent. The wether hoggets of this cross show a decided improvement upon the last lot, and is a well-grown type of wool. It has a lengthy, sound staple, with an even crimp from base to tip, the merino strain being very distinct. This is a good payable class of wool to grow, and I would say in this case the cross is a success.

"Shropshire-Merino Half-bred, 4-tooth.—This wool does not give justice to this cross, being short, thin, and mushy or wasty. It might be taken for a Southdown cross. Spinning counts, 60's; clean yield, 60 per cent. It is a hosiery wool.

"Lincoln Stud Ram.—Is one of those sound well-bred wools a breeder likes to see on a sire, having a good amount of masculinity, body or substance, still full of quality. There is a great depth of a bold, firm, commanding staple, showing a typical even wave and a nice glossy or lustrous appearance. It is a commendable class of Lincoln wool.

"Lincoln-Merino Half-bred Ewe Hogget.—Nos. 37, 36, 38, 39, 43, 42, 40, 34.—These numbers are arranged according to quality. The two first are exceptionally fine for this cross, and could be sold for come-back wool. I consider all these fleeces are full of merit, and form most useful and valuable grades of cross-bred wools, the merino character showing out distinctly, whilst the Lincoln length and colour are pronounced. As a commercial wool, it is a commendable style, and would realise extreme rates if in quantity. There is sufficient body and stamina to recommend the ewes for experimenting purposes, and it would be interesting to see the result if crossed again on to the merino. Spinning counts from 60's and 44's; clean yield, 58 per cent.

"Nos. 35, 44, 41.—These are the faulty wools, and do not show the true characters of the cross.

"The Wether Hoggets.—There are many useful and serviceable grades of wool of a good paying class. As regards length, colour, and quality, there is nothing wanting. Spinning counts, 46's; average clean yield, 56 per cent.

"English Leicester Ram.—This is a fairly good specimen of a ram's wool of this breed. There is an average length of a nice even growth, the staple being well formed and wavy, showing a true silvery lustre. A want of density is the only drawback. Spinning counts, 36's; clean yield, 62 per cent.

"Leicester-Merino Ewe Hogget, Half-bred.—Nos. 55, 63, 61, 56, 62, 59, 51, and 60. These numbers are classed according to merit, and form an exceptionally high grade of cross-bred wool, mostly leaning to the merino, yet showing the length and brightness of the Leicester. As an even well-grown wool, full of quality and soundness, there is little to be desired. Spinning quality from 44's to 56's; clean yield 57 per cent. No. 58 of the last cross is the only faulty sample of the above collection, being of a rather spongy open nature, with a rather straight formation. Spinning counts, 40's to 44's; clean yield, 59 per cent.

"Leicester-Merino Half-bred Wether Hoggets.—These wools vary much more than the ewes, both in quality and length, especially on the backs. Two of the fleeces were very desirable commercial types, whilst the remainder were faulty both in length and style. Spinning counts, 44's to 60's; yield 55 per cent.

"Border Leicester Ram.—This wool is of a robust type for this breed, showing a massive staple and too much lustre, leaning to the pure Leicester. The Border Leicester type of wool is a demi-lustre, meaning half-lustre. It is a useful type of wool, and would give good results for the manufacturer. If used for breeding pure Border Leicesters, this ram should be mated with the finer-wooled ewes. Spinning counts, 36's to 40's; clean yield, 63 per cent.

"Border Leicester Half-bred Ewe Hoggets.—Nos. 47, 50, 48, 49, 46, and 52, are arranged according to merit, representing the finer to the lower grades. As crossbred wools these fleeces are very stylish showing plenty of the merino character, still having a sound healthy growth from the finest to the strongest. From a breeders' and manufacturers' view their quality and weights are most satisfactory. Spinning counts, 36's to 46's; clean yield, 60 per cent. Numbers of the same breed 53, 45, 54, and 51. Evidently these wools have suffered on account of the ewes being good breeders, throwing twins, &c., others from this cross being twins. There is not that style or growth in these wools, as in the first noted of this cross, and are more of a hosiery grade than a combing class. Clean yield, 57 per cent. The wethers of this cross have given fleeces of a most useful and commendable grade, lengtby, bold, sound, bright, free, robust, but still full of quality. As a commercial wool there is nothing wanting. Spinning counts, average 50's; clean yield, 58 per cent.

"Shropshire-Border Leicester-Merino Ewe Hogget (twin).—This is not unlike a half-bred Shropshire-Merino, and would pass for the same in the wool sales. Evidently the Border Leicester has not imparted that strain, both brightness and length is wanting, and the fibre takes after the Shropshire strain."

The above figures and remarks should be helpful in drawing conclusions respecting the merits of the various crosses. The principal object of the experiments is to provide data which may be helpful to the farmers in the production of lambs for export. With this object in view the following recommendations are repeated (*vide Agricultural Gazette*, February, 1905, pages 146–8):—

"It is preferable to breed from six-toothed ewes which have already dropped one lamb, as younger ewes losing their teeth cannot do justice to their lambs if the seasons are at all unfavourable. Breed from fair to good ewes, old culls will not give satisfactory results. Half-bred ewes make better mothers than pure Merinos, having a larger percentage of lambs, which they rear more satisfactorily. Lambs should be ready for sale at from four to five months; to ensure this, green food should be provided for the ewes during the winter, and also the dry summers. Lambs for export should weigh from 30 to 40 lb. dressed weight. In choosing English rams for mating with Merino ewes, large heads should be avoided, if possible, without sacrificing masculinity. The crosses strongly to be recommended for the conditions of this district are those from Lincoln-Merino, half-bred ewes, and from Border Leicester-Merino, half-bred ewes mated with Shropshire rams. Good rams of the various breeds should be used. Good lambs must have good mothers, and good mothers must have good pastures, or substitutes for them."

These sheep are carried upon the farm in conjunction with the various operations, all of which are carried out upon an area of under 700 acres in extent. Crops such as rape, tares, scarlet clover, cowpeas, &c., being grown in rotation with wheat and other cereals, such crops being turned to profitable account in this direction, as well as being the means whereby fertility is retained.

Ploughing under Rape at the Bathurst Farm.

R. W. PEACOCK.

In the profitable retention of the fertility of the soil at the Bathurst Farm, rape plays an important part. For the sheep carried on the farm an area of rape is sown in February upon the basis of ten sheep to the acre. By the end of April it is ready for the sheep, which are grazed upon it throughout the winter and early spring. During October, when other feed is available, the crop is let run up to flower and is ploughed under early in November before the seeds sufficiently mature to germinate. A crop of green stuff

Ploughing under Rape at the Bathurst Farm.

4 to 5 feet high is thus ploughed under which becomes available as plant food for the following wheat crop. The physical condition of the soil is improved and its water-holding capacity is increased. Excellent results follow such methods; from 30 to 40 bushels of wheat being obtained per acre. The standing crop is ploughed under with the aid of chains. One end of a chain is attached to the right beam of the plough and the other to the left, and is of sufficient length for the loop formed to lie in the furrow just in front of the fresh sod falling into position. The loop pulls the standing crop into the furrow, it being covered by the furrow slice before it has time to rise. On a single furrow plough one end of the chain is attached to the beam in front of the coulter, and the other end to the swingle-bar of the furrow horse, the loop being in the same position. Other green crops may be covered similarly.

Ducks and Duck Farming

[Continued from page 1242.]

D. S. THOMPSON,
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VII.

FEEDING.

The general management of a duck farm is simply a question of how to run a duck farm, with a view of making it a profitable investment. It has already been pointed out how a duck farm can be started and successfully run with a very small capital invested. Yet it may be stated that ducks will respond to a more liberal investment of capital, the same as any other kind of stock. The man who can afford to build a duck-house to hold a large number of ducks, divided into sections with wire divisions only, thus dividing the ducks into

Open-front Duck House.

lots of twenty, with grass runs immediately behind the shed, the building to stand facing the north-east, with wire front, and solid back and roof only ; the ducks shut up in this house nightly (they will not resort to it themselves, no matter how much more comfortable it is than out in the cold and wet), bedded on plenty of straw, with plenty of drinking water from a spout running the whole length of the building, plenty of dry feed in their troughs, and fed at regular intervals with mash and meat, and only allowed out after the keen cold of the winter nights had gone ; but while this can be done, and extra profits obtained, yet the man with very limited capital has a much better chance of succeeding in duck farming than in many other pursuits.

The general farmer to-day will tell you poultry-keeping will not pay, and that they are only a nuisance about the place, yet he drags on to the wheels of the public coach by keeping a lot of barndoors, of all ages, and with as many males as females, allows them to roam promiscuously, roost anywhere, and lay when and where they like. When they do lay in spite of his careless efforts to stop them, he sends some of the children round to pick up the eggs they may see lying about, boxes them up, and sends them into the market. Then, again, the fowls and the ducks that he has running about the farm, just because they are a nuisance to him, have persisted in laying in some out-of-the-way spot, and a few old broodies have found them and hatched out a number, and as they are getting rather numerous for his liking, he gets some of the boys to box up a hundred or two and send them into Sydney to fetch anything they will bring.

The general farming community to-day are just as great in their unbelief in regard to profitable poultry farming as they were many years ago. Yet there is no one who would benefit more from scientific poultry farming than the general farmer. He already has his farm under cultivation, and the growing of crops has been a success with him.

Since the suitability of green food, in conjunction with different kinds of grain, has been established, the feeding of fowls and ducks is much easier solved than it was years ago, before the feeding of green crops to poultry was understood. Any farmer could live without having recourse to outside sources of food supply for the cultivation of ducks. If settled in a wheat-growing district, he could grow wheat and, perhaps, lucerne, and this combination would be all that is necessary to raise ducks. The wheat could be boiled and crushed up with the green cut lucerne. If settled in a maize-producing district maize could be grown, and with the combination of lucerne, a good evenly-balanced ration could be struck for profitable duck rearing. Lucerne is a fodder which, although for many years used for other stock, has only recently come into use as a poultry food. Dry chaffed lucerne makes an excellent component part of a poultry food, but lucerne's real excellence is found in its green state. The supply of green food is very important, as it has been found to take the place of mill offal, which has always to be purchased. Lucerne has been found to make up a considerable part of the bulk food with marked success in practice; by the analyst it has been demonstrated to be a food of very rich feed-value to stock; and its application practically has been borne out by results in poultry feeding.

In regard to lucerne and its cultivation, Mr. H. W. Potts, the Principal of the Hawkesbury Agricultural College, says:—"Increased attention is now being devoted to lucerne cultivation. The plant thrives best in a rich calcareous soil. It is practically immaterial whether the lime be found in the soil or subsoil. Lucerne seems to do well in *any soil with a porous subsoil*, which is open and so located as not to permit of water lodging either on top or in the subsoil. It is surprising how lucerne will thrive even on poor soils so long as the drainage is adequate and the soil of sufficient depth. The striking feature of its growth is the power of the plant to be independent of rain, owing to the extraordinary facility it possesses of penetrating many feet to secure moisture. The desirable food element in lucerne is protein or albuminoids—*i.e.*, the nitrogenous compounds. It is this quality which makes lucerne so valuable for producing beef or milk, or as a portion of a horse ration; in fact, as a valuable nutritive substance it is useful for all domestic animals and poultry, and in every way rivals bran. The food constituents of bran and lucerne are for all feeding purposes equal. This explains to a great extent how the supply of lucerne practically controls the demand for bran in the open market. The protein contents of lucerne is about equal to that of bran, but the stalks of the lucerne plant only contain about one-fourth."

Green feeding is increasing amongst American poultry-men every year. An American writer says, "The duck feeder would no more think of omitting green food from a single feed than he would of shooting his ducks." In respect to the cultivation of lucerne in America for poultry-feeding, a writer in the American *Poultry Journal* says, "Alfalfa is a comparatively new forage plant in this country. It has been cultivated in Western Asia for twenty centuries, and was introduced into Greece about 470 B.C. Its botanical name is *Medicago sativa*. It is known as lucerne in England and other parts of Europe. It belongs to the same family of legumes as clover, and is admitted to be the very best fodder-plant known. It is the best hay and soiling crop in the west, and in the middle and eastern States is rapidly supplanting red clover. In Kansas and Colorado, where it is very extensively grown, it is cut three times during the season. It should be cut just before the plant begins to bloom in order to obtain the greatest amount of nutrition in the hay. If it can be procured and fed green to poultry, there is nothing to equal it, and as hay it bears the same relation to red clover as 11 to 7. Analyses vary with the time of cutting from as low as 11 per cent. to as high as 22 per cent. of protein, the higher percentage being found in cutting for the third time, and only twenty days after the previous cutting. The average analysis indicates 15·6 per cent. protein, 46·6 per cent. carbo-hydrates, and 4 per cent. fat, which is a nutritive ratio of about 1 to 3½. This illustrates its feed value, which has been found to work out in practice."

The importance of the feeding of green food to poultry-farming, although somewhat new, is of so much importance, that it is the only apology we can offer for digressing into the field of the agriculturist.

With an ordinary patch of ground growing maize and lucerne, or wheat and lucerne, duck farming can be carried on with considerable profit. In farming ducks without buildings, where winter breeding will be required, a small coop like the illustration, or a number of them, would be very useful for preventing the eggs from getting frost-bitten. With plenty of straw or hay bedding, and a few nest eggs, the ducks will frequently resort to these nests during the night, instead of laying in the open yard. Meat-feeding is very essential to successful duck farming, and if meat can be obtained cheaply, it should be fed to them, but they can be successfully fed and reared without it, without any damaging effects.

Bullocks' livers and sheep's frys make excellent soup for mixing the mash, and also bullocks' heads and sheep's heads, which can be purchased cheaply, if the buyer can call at the abattoirs for them.

In nature, the food of the duck is both vegetable and animal. In their wild state, they live principally on marshes, where they feed on green weeds and grasses, insects and fish, and in confinement, to get the best results out of them, the combination of vegetable and animal food is equally necessary. The duck has no crop like a fowl, and the food passes directly to the gizzard. This is the reason why ducks do better on soft food. Too much grain will not give the best results, but a farmer growing his own grain can, with plenty of lucerne and crushed grain, get equally as good results as from pollard and bran feeding.

Laying Coop for Ducks.

In breeding ducklings for export, it is necessary to breed from a quick-maturing strain of Pekins, to obtain the required weight for export at ten to twelve weeks, of not less than 4½ lb. live weight. We have two classes of this duck: the ordinary-framed Pekin—pure Pekin blood, but small in frame; they are very prolific, will lay almost as well as the crack Indian Runners and Buff Orpingtons, and their eggs are very fertile. Then we have the giant-framed Pekins; they are much larger than the ordinary Pekins; they are bred by selecting the largest birds for reproduction. The eggs are not so fertile as the ordinary Pekin, but the birds attain a much larger frame, and carry more flesh right from the first or second week from hatching. Ordinary Pekin ducks will weigh at full maturity, say twelve months, 5 lb. for ducks, and 6 lb. for drakes, while the giant Pekins at twelve months will go 8 or 9 lb. for ducks, and 11 lb. for drakes. At ten to twelve weeks, the ordinary Pekin cannot be forced up to 4½ lb. live weight, or 4 lb. dressed, in quantities, whereas the giant Pekin will reach 6 lb. live weight, or 5½ lb. dressed, and at the same cost of feeding. On the 4th October, we filled up a Nonpareil incubator with fifty eggs of the ordinary small Pekin. On the seventh day, we tested out ten infertile eggs, and on the 1st November we counted out thirty-five ducklings out of the forty fertile eggs in the machine, five having died in the shell. The thirty-five ducklings were placed in a Cypher sectional brooder, placed in the brooder-house, and they got on well from the start. They were fed on chicken mixture for the first week, and then crushed maize always before them in earthenware dishes, plenty of sand in the brooder, plenty of clean water in the fountains, and fed six times a day on bran and pollard mixed dry and crumbly, and occasionally scraps of meat from the kitchen, also green-cut lucerne daily. The Cypher sectional brooder was run at 90° Fah. for the first week, 80° Fah. for the second week, and, as the weather was warm and genial, the light was put out during the third week. After the first week, the ducklings had the run of the brooder-house, and at four weeks they were allowed out on the grass. At twelve weeks they were weighed and found to average 4¼ lb., and though we kept them for four weeks longer, they only gained about 5 lb. on the thirty ducklings, so that they should have been marketed at twelve weeks, as we kept them four weeks for practically no gain. At sixteen weeks they were sent to the export stores at Darling Harbour for export to London, but they were rejected as undersized. With every care and attention the ducklings could not be induced to put on the weight necessary for export, viz., 4½ lb. live weight, so instead of being forwarded to London they were held in cold store for use later at the College on Diploma Day, when for juicyness and fine texture they were highly commended. These ducklings cost 4d. per lb. to produce, or 1s. 2½d. each duckling. The cost was made up as follows:—

	£	s.	d.
20 bushels pollard at 9½d.		15	10
6 ,, bran at 8¾d.		4	4½
3 ,, cracked maize at 2s. 9d.		8	3
Chicken mixture		2	0
Feed total	£1	10	5½
50 eggs at 1s. doz.		4	2
Oil for incubator		2	6
	£1	17	1½

Or an average of 1s. 2½d. each for thirty ducklings. At the same time we raised a few giant Pekin ducklings, which at twelve weeks weighed 6 lb. each live weight.

Ducklings for the London market should be hatched out in the months of October, November, and December, they should be killed at from ten to twelve weeks, according to how the ducklings are feathering—killing should take place just before the pin feathers shoot—and despatched to London in February, March, and April, when they would arrive on the London market in March, April, and May, when ducklings well-grown will fetch good prices. These dates suit us very well to breed here, and with the right class of duck a profitable trade ought to be easily found.

(*To be continued.*)

Forestry.

Some Practical Notes on Forestry suitable for New South Wales.

[Continued from page 1112, vol. XVI.]

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XII.

Sylvicultural Conditions of New South Wales Native Trees.

No list of New South Wales trees, at all events with anything like the fullness of the present one, has yet been published. Certainly no attempt to summarise their habitats and "sylvicultural conditions" has yet been made, and this is a matter in regard to which our own people and foresters outside Australia are continually seeking information.

The following list of 521 species and varieties of trees can only be taken as approximate, for in the course of time it must be added to. Even yet New South Wales is imperfectly explored, and year by year trees are discovered which were supposed to be peculiar to the other States, and others, supposed to be but shrubs in this State, are found to attain tree size within its boundaries.

It is not always possible to define what a tree is. The old definition of a tree—a plant with a single woody stem, in contradistinction to a shrub, where several woody stems spring up from the ground, is not always literally true. Of course, with most plants it is easy enough, and the minimum size of a tree has usually been taken at about 25 feet, with a stem diameter of 9 inches. Such a minimum-sized tree may possibly produce "timber" for small articles, or at all events yield fuel or rails. In any case it is termed a "tree" in common parlance.

The differentiation of the earth's vegetation is controlled by three factors—

(*a.*) Heat (see an Isothermal Map).

(*b.*) Atmospheric precipitation (including winds). (See the Observatory Rain Map).

(*c.*) Soil. (See the Geological Map of the Geological Survey, which is very suggestive in this connection).

"Heat determines the flora, climatic humidity the vegetation; the soil as a rule merely picks out and blends the material supplied by these two climatic factors, and on its own account adds a few details."—(Schimper.)

We have various kinds of climate, which have considerable influence on the vegetation, *e.g.*—

1. The salt-laden air of the coast, often accompanied by winds.
2. The forcing steamy atmosphere of the "brushes."
3. The cold, bracing atmosphere of the table-lands.
4. The dry atmosphere of the Western plains.

Coming to the soils, we have, for example :—

1. The sandy lands of the Coast, together with the brackish swamps and tidal rivers.

2. The moist soils of river-banks and fresh-water swamps.

3. The sterile soils of the Hawkesbury sandstone, characteristically developed in the Coast Range (including Sydney and the Blue Mountains), but supporting very gardens of flowers.

4. The better soils of the Wianamatta shales. The Wianamatta shale is a mud deposit on the Hawkesbury sandstone in the counties of Cumberland and Camden—say Burwood and Homebush (near Sydney), Parramatta to Penrith, thence north in the fruit-growing districts, *e.g.*, Galston and Glenorie. Then going south, Picton and surrounding districts (including Sutton Forest).

5. The rich soils of the Brushes, often the product of decomposed volcanic rocks, but often made up of soil obtained from other sources—washed down from high levels and moistened by streams. The decomposition of basalt or "trap" yields the richest soils in the State; this is the soil and that marvellous vegetation (now rapidly disappearing for dairy farms) of the "Big Scrub," of the Richmond River, and brushes generally.

6. The granite soils, found in many places all over the State, *e.g.*, Tarana to Bathurst, Young to Harden, New England.

7. The calcareous or limestone soils, *e.g.*, Yarrangobilly to Yass, Jenolan to Wombeyan, Bungonia, Nundle, Macleay. Limestone country is, of course, cave country.

8. The black soil plains of the inner West.

9. The sandy soils of the West.

I have made the following ten divisions as convenient in practice. They are not of equal value, and some refer chiefly to soil, others to climate :—

1. Sandy coast-land and sea-side situations generally.
2. Tidal rivers and brackish swamps (saltwater).
3. River banks and swamps (freshwater).
4. Brushes.
5. Between coast and coast-range.
6. Table-lands and mountains (say 1,000-3,000 feet).
7. Alpine situations.
8. Open forest (grass-land).
9. Western slopes.
10. Dry western plains.

Obviously, as regards the localities indicated by the numbers, "averages" only have been taken, but I think they will be of value as pointers. In some cases the letters N. and S. (north and south) have been added with the view to greater precision.

Explanation of terms.

(1), (2), and (3) seem to be self-explanatory. Sea-side situations are, however, not always sandy.

(4.) A "brush" corresponds to what in India would be called jungle, and consists of well-watered, sheltered rich-soil areas in the coast districts and valleys of the coast ranges, which not only support rich arboreal vegetation, but also creepers and climbers of various kinds, and shrubby undergrowth. The tree vegetation is of a most varied kind, but rarely includes eucalypts. The soil of brushes is not always volcanic; in the county of Cumberland, for example, the Wianamatta shales often give the necessary richness of soil. In brushes the variety of trees is very great, and they are less gregarious than those of the open forest. There is a good deal of uniformity in the barks of the trees—a nearly smooth bark being of very common occurrence, while the trees are so close together that their leafy tops intertwine, and it is impossible, in many cases, to get a fair idea of the shape and general appearance of a particular tree. Only those who have visited our dense northern brush forests can form an idea of the difficulty of distinguishing more than a few kinds of trees. The massive trees, wonderfully vertical, remind one of cathedral columns; craning the neck for an upward view in the dim forest light is inconvenient and painful, and results in only general impressions, while, if a gun be fired with the view of bringing down a twig for purposes of identification, the probability is that it cannot be stated, with certainty, from what particular tree the specimen has fallen. If one cuts through a tree, it very often happens that other trees prevent its falling down, and thus its leafy top is not available for examination.

(5.) "Between coast and coast-range" is rather a vague term used to indicate trees which grow in the coastal belt from the sea-level to say 1,000 feet. Much of the country is grass-land, and also sides of hills mostly with an easterly aspect.

(6.) Table-lands and mountains (say 1,000 to 3,000 feet) will roughly include the Blue Mountains, and such districts as New England and the Southern Tableland. Many English trees flourish in this area.

(7.) "Alpine situations" is taken to indicate the coldest situations in the State, and includes not merely such mountains as Kosciusko, but anything between 3,000 or 4,000 and 6,000 feet.

(8.) "Open forest (grass-land)" is employed in a general sense.

In open forests eucalypts form the prevailing vegetation in the coast districts and also on the western slopes, and frequently attain a great size. As compared with brush forests, the soil is less rich and moist. Of the open forest timbers we may say that we possess a fair knowledge; it is mainly in regard to the brush-timbers that our knowledge is defective.

(9.) "Western slopes."—These connect the table-land with the western plains, and include the "Central Counties" of my address.* The three counties included have been defined as follows (p. 767):—

"C. 1. Wagga-Forbes-Dubbo County.

"This is another of the intermediate counties. It connects the table-land with the western plains.

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* Presidential address to the Linnean Society of New South Wales, 26th March, 1902, "Botanical Survey of New South Wales: A Botanical Map."

"Its boundaries are—east, southern table-land and Liverpool Range county; north, Liverpool Plains; west, conventional lines joining Coonamble to Dubbo, Dubbo to Narrandera, and Narrandera to Corowa [a more correct boundary would be a somewhat sinuous line between Narrandera, Forbes, and Dubbo]; south, Murray River.

"C. 2. Liverpool Plains County.

"I would define it as including the counties of Darling, Nandewar, Jamison (eastern half), Baradine (eastern half), White, Pottinger, Buckland, Parry, and the western half of Inglis. Bounded on the east by New England; on the west it tapers off into the sterile sandy country, and is bounded by a conventional line from Coonamble to Bogabilla; on the south by the Liverpool Range. Mean elevation say 900 feet.

"C. 3. Macintyre-Gwydir County.

"It includes the upper waters of the Macintyre and Gwydir.

"It slopes from New England to the west, where it joins the sandy or sterile plains, being bounded by the conventional line from Coonamble to Bogabilla. It is a county corresponding in some respects (though drier) to the Upper Richmond-Clarence county on the east.'

(10.) "Dry Western Plains."

The Western plains comprise the greater portion of New South Wales, extending from north to south. There is considerable uniformity in the flora, and although attempts have been made to break down the enormous area, for our present purpose it may be looked upon as a whole. The dryness of the climate and of the soil are modified by the presence of watercourses (usually intermittent) and subterranean areas where water accumulates.

Whether a shrub or a tree will grow on a definite area depends upon the circumstance whether there is subterranean moisture to support the existence of a tree. While by keeping the soil open and supplying plant-food much can be done towards improving the western vegetation—since the roots of plants travel after water—the size of the plant that can grow at a given spot depends on the depth at which subterranean water (if any) can be reached.

The depressions (gilgais) in the west are characteristic of the presence of water.

Native Trees of New South Wales.

NOTE.—The letters N and S indicate north and south of Sydney. It will be observed that, as regards the brushes (4), the vast majority of them do not come south of Sydney.

Anonaceæ—
- Polyalthia nitidissima, Benth. **4** (N).
- Eupomatia Bennettii, F.v.M., "Native Cinnamon." **4** (N).
- laurina, R. Br., "Balwarra." **4.**

Capparidaceæ—
- Capparis nobilis, F.v.M. (*C. arborea*, F.v.M.), "Native Lemon." **4.**
- Mitchelli, Lindl, "Native Orange." **9-10.**

Flacourtiaceæ (*Bixineæ*)—
- *Scolopia Brownii, F.v.M. **4.**

Samydaceæ—
- Casearia esculenta, Roxb. **4** (N).

* The trees indicated by an asterisk have already been figured and fully described in my "Forest Flora of New South Wales" (Government Printer, Sydney), and the work is being pushed on as rapidly as the artist can finish the plates.

Pittosporaceæ—

Pittosporum rhombifolium, A. Cunn., "White Holly." **4** (N).
undulatum, Andr., "Common Pittosporum." **4.**
*phillyroides, DC., "Narrow-leaved Pittosporum." **9, 10.**
bicolor, Hook, "Bonewood." **4** (S).
Hymenosporum flavum, F.v.M., "Wollum-Wollum." **4** (N).
Bursaria spinosa, Cav., "Black-thorn" or "Box-thorn." **3, 8.**
Citriobatus lancifolius, Bail. **4** (N).

Malvaceæ—

Hibiscus heterophyllus, Vent., "Green Kurrajong." **4.**
tiliaceus, Linn. **2** (N).

Sterculiaceæ—

Sterculia quadrifida, R. Br., "Calool." **4** (N).
Brachychiton discolor, F.v.M. (*Sterculia discolor*, Benth.; *S. lurida*, Benth.), "Sycamore." **4** (N).
acerifolius, F.v.M. (*Sterculia acerifolia*, A. Cunn.), "Flame-tree." **4.**
populneus, R. Br. (*Sterculia diversifolia*, G. Don.), "Kurrajong." **6, 9, 10.**
Tarrietia argyrodendron, Benth. "Byong," "Ironwood." **4** (N).
actinophylla, Bail., "Black-Jack." **4** (N.).

Tiliaceæ—

Grewia latifolia, F.v.M. **4** (N).
Sloanea australis, F.v.M., (*Echinocarpus australis*, Benth.) "Maiden's Blush." **4.**
Woollsii, F.v.M., "Carabeen." **4.**
Elæocarpus holopetalus, F.v.M., "Prickly Fig," "Blue-berry Ash" **4.**
obovatus, G. Don., "Native Ash." **4.**
reticulatus, Sm. (*E. cyaneus*, Ait.), "Small Blue-berry Ash." **4.**
longifolius, C. Moore (*E. Baeuerleni*, Maiden and Baker), "Blue-berry Ash." **4.**
eumundi, Bailey. **4** (N).
grandis, F.v.M., "Calhoun," "Coast Quandong." **4** (N).

Rutaceæ—

Phebalium Billardieri, A. Juss. (*Eriostemon squameus*, Lab.) **4.**
Bosistoa sapindiformis, F.v.M. (*Euodia pentacocca*, F.v.M.), "Union Nut." **4** (N).
euodiformis, F.v.M. **4** (N).
Melicope erythrococca, Benth. (*Euodia erythrococca*, F.v.M.) **4** (N).
australasica, Benth. (*Euodia octandra*, F.v.M.,) **4** (N).
Bouchardatia neurococca, Baill. (*Melicope neurococca*, Benth.) **4** (N).
Euodia micrococca, F.v.M. **4.**
xanthoxyloides, F.v.M. **4** (N).
*accedens, Blume. **4** (N.).
Medicosma Cunninghamii, Hook. f. (*Euodia Cunninghamii*, F.v.M.), "Glue Gum." **4** (N).
Xanthoxylum brachyacanthum, F.v.M., "Thorny Yellow-wood." **4** (N).
Geijera Muelleri, Benth., "Axe-breaker." **4** (N).
salicifolia, Schott, "Lignum Vitae." **4.**
var. angustifolia, Maiden and Betche. **6.**
parviflora, Lindl., "Wilga." **9-10.**
Pleiococca Wilcoxiana, F.v.M. **4** (N).
Pentaceras australis, Hook. f., "Scrub Hickory." **4** (N).
Acronychia Baueri, Schott, "Brush Ash." **4.**
lævis, R. and G. Forst., "White Lilly Pilly." **4.**
imperforata, F.v.M. **4** (N).
melicopoides, F.v.M. **4** (N).
acidula, F.v.M. **4** (N).
Halfordia drupifera, F.v.M., "Boogoogin." **4** (N).
scleroxyla, F.v.M. **4** (N).
Atalantia glauca, Hook. f., "Native Kumquat." **4** (N.) **9.**
Citrus australis, Planch (*C. Planchonii*, F.v.M.) "Native Lime." **4** (N).
australasica, F.v.M., "Finger Lime." **4** (N).

Simarubaceæ—

Ailanthus imberbiflora, F.v.M. **4** (N).
Cadellia pentastylis, F.v.M. **4** (N) **6.**
monostylis, Benth. **4** (N).

Meliaceæ—

Melia Azedarach, Linn, var. australasica, C. DC. (*M. composita*, Willd), "White Cedar." **4, 9.**

Dysoxylum Muelleri, Benth, "Red Bean," "Pencil Cedar." **4** (N).

Becklerianum, DC. (*D. Lessertianum*, Benth, var. *pubescens*, Benth.). **4** (N).

Lessertianum, Benth., "Rosewood." **4** (N).

rufum, Benth., "A Bastard Pencil-cedar," "A Stink-wood." **4** (N).

Amoora nitidula, Benth., "A Bog-onion." **4** (N).

Synoum glandulosum, Juss., "Bastard Rosewood." **4.**

*Owenia acidula, F.v.M., "The Gruie or Colane." **9, 10.**

cepiodora, F.v.M. **4** (N).

*Cedrela australis, F.v.M. (C. Toona. Benth.), "Red Cedar." **4.**

*Flindersia australis, R. Br., "Teak." **4** (N).

*Schottiana, F.v.M., "Cudgerie." **4** (N).

*Oxleyana, F.v.M., "Yellow Wood." **4** (N).

*Bennettiana, F.v.M., "Bogum-bogum." **4** (N).

*collina, Bail., "Stave-wood." **4** (N).

*maculosa, F. v. M. (*F. Strzeleckiana*, F. v. M.), "The Leopard Wood." **10.**

Olacaceæ—

Pennantia Cunninghamii, Miers. **4.**

Chariessa Moorei, Engler. (*Villaresia Moorei*, F. v. M.), "Soap-wood," "Native Maple." **4.**

Celastraceæ—

Celastrus dispermus, F.v.M. **4** (N).

bilocularis, F.v.M. **4** (N).

Cunninghamii, F.v.M. **4.**

Denhamia pittosporoides, F.v.M. (also var: *Dunnii*, Maiden and Betche.) (*Leucocarpum pittosporoides*, F.v.M.) **4** (N).

Elæodendron australe, Vent., "Blue Ash." **4.**

*Siphonodon australe, Benth., "Ivory Wood." **4** (N).

Rhamnaceæ—

*Ventilago viminalis, Hook., "Supple Jack." **10.**

*Alphitonia excelsa, Reiss., "Red Ash." **4.**

Emmenospermum alphitonioides, F.v.M., "Bone-wood." **4** (N).

Pomaderris apetala, Lab., "Hazel." **3.**

cinerea, Benth. **3.**

Sapindaceæ—

Atalaya multiflora, Benth. **4** (N).

*hemiglauca, F.v.M., "Western Whitewood." **10.**

Diploglottis Cunninghamii, Hook. f. (*D. australis*, Radlk.), "Native Tamarind." **4.**

Castanospora Alphandi, F.v.M. (*Nephelium Callarie*, Bail.) **4** (N.)

Cupania Wadsworthii, F.v.M. (*Harpullia Wadsworthii*, F.v.M.) **4** (N).

*anacardioides, "A. Rich. (*Cupaniopsis anacardioides*, Radlk.), A Cupania." **1, 2.**

serrata, F.v.M. (*Cupaniopsis serrata*, Radlk.), "Gulwin-Gulwin." **4** (N).

punctulata, F.v.M. (*Cupaniopsis punctulata*, Radlk.) **4** (N).

pseudorhus, A. Rich. (*Jagera pseudorhus*, Radlk.), "Iccaaya." **4** (N).

xylocarpa, A. Cunn. (*Elattostachys xylocarpa*, Radlk.), "Wootarie." **4** (N).

var. nervosa, F.v.M. (*C. nervosa*, F.v.M.) **4** (N).

pyriformis, F.v.M. (*Ratonia pyriformis*, Benth.) **4** (N).

anodonta, F.v.M. (*Ratonia anodonta*, Benth.) **4** (N).

stipitata, F.v.M. (*Ratonia stipitata*, Benth.) **4** (N).

tenax, A. Cunn. (*Ratonia tenax*, Benth.) **4** (N).

Nephelium semiglaucum, F.v.M. (*Cupania semiglauca*, F.v.M.) "Wild Quince." **4.**

connatum, F.v.M. (*Alectryon connatus*, Radlk.) **4** (N).

subdentatum, F.v.M. (*Alectryon subdentatus*, Radlk.) **4** (N).

Forsythii, Maiden and Betche, (*Alectryon Forsythii*, Radlk.). **6.**

tomentosum, F.v.M. (*Alectryon tomentosus*, Radlk.) **4** (N).

coriaceum, Benth. (*Alectryon coriaceus*, Radlk.) **4** (N).

leiocarpum, F.v.M. (*Alectryon subcinereus*, Radlk.) **4.**

foveolatum, F.v.M. (*Arytera foveolata*, Radlk.) **4** (N).

divaricatum, F.v.M. (*Arytera divaricata*, Radlk.), [Syn. *N. Beckleri*, Benth.] "Coogera." **4** (N).

distyle, F.v.M. (*Ratonia distylis*, F.v.M.) **4** (N).

Sapindaceæ—*continued.*

*Heterodendron oleæfolium, Desf., "Western Rosewood." **9, 10.**
diversifolium, F.v.M. **4** (N).
Harpullia alata, F.v.M. **4** (N).
Hillii, F.v.M. **4** (N).
pendula, Planch. **4** (N).
Akania Hillii, Hook. f. **4** (N).

Anacardiaceæ—

*Rhodosphæra rhodanthema, Engler (*Rhus rhodanthema*, F.v.M.), "A Yellow-wood." **4** (N).
Euroschinus falcatus, Hook. f. **4** (N).

Leguminosæ—

Jacksonia scoparia, R.Br., "Dog-wood." **5, 6, 8.**
Daviesia corymbosa, Sm. var. arborea, Maiden (*D. arborea*, F.v.M. et Scortech.) **6.**
Erythrina vespertilio, Benth., "Bats'-wing Coral." **4** (N).
*Castanospermum australe, A. Cunn., "Black Bean." **4** (N).
*Barklya syringifolia, F.v.M. **4** (N).
Cassia Brewsteri, F.v.M. **4** (N).
Bauhinia Carronii. F.v.M. **4** (N).
Acacia sentis, F.v.M., "Thorny Wattle." **10.**
penninervis, Sieb., "Mountain Hickory." **6, 7.**
neriifolia, A. Cunn. **6.**
pycnantha, Benth., "Broad-leaved Wattle." **9, 10.**
notabilis, F.v.M. **9, 10.**
hakeoides, A. Cunn., "Western Black Wattle." **9, 10.**
salicina, Lindl., "Kooba." **9, 10.**
leptopetala, Benth. **10.**
lunata, Sieb. **5.**
podalyriæfolia, A. Cunn., "Broad-leaved Silver Wattle." **9.**
subporosa, F.v.M., "River Wattle." **3, 5, 6** (S).
homalophylla, A. Cunn., "Yarran." **9, 10.**
Cambagei, R. T. Baker. "Gidgee," or "Stinking Wattle." **9, 10.**
*pendula, A. Cunn., "Weeping Myall." **9, 10.**
Oswaldi, F.v.M., "Miljee." **9, 10.**
coriacea, DC.. **10.**
stenophylla, A. Cunn., "Munumula." **9, 10.**
*melanoxylon, R.Br., "Blackwood." **5, 6, 7, 8.**
implexa, Benth., Hickory." **5, 6, 8.**
harpophylla, F.v.M., "Brigalow." **9, 10.**
excelsa, Benth., "Ironwood." **9, 10.**
binervata, DC., "Two-veined Hickory." **4, 5, 6.**
Bakeri, Maiden. **4** (N).
longifolia, Willd., "Golden Wattle." **1, 3, 5.**
cyperophylla, F.v.M. **9, 10.**
aneura, F.v.M., "Mulga." **10.**
doratoxylon, A. Cunn., "Currawang." **9, 10.**
glaucescens, Willd., "Coast Myall." **3, 5, 6.**
Maideni, F.v.M., "Broad-leaved Sally." **4, 5, 6.**
Cunninghamii, Hook., "Bastard Myall" or "Kurracabah." **5, 6, 8, 9.**
*aulacocarpa, A. Cunn., "Brush Ironbark." **4.**
elata, A. Cunn., "Pepper-tree Wattle" or "Cedar Wattle." **3, 4, 5, 6.**
pruinosa, A. Cunn., "Mealy-stemmed Wattle." **4, 5.**
Baileyana, F.v.M., "Cootamundra Wattle," **6.**
Muelleriana, Maiden and Baker. **3.**
decurrens, Willd., "Black or Green Wattle." **5, 6, 8.**
dealbata, Link., "Silver Wattle." **5, 6, 8.**
pubescens, R.Br. **5.**
*Albizzia pruinosa, F.v.M. (*Pithecolobium pruinosum*, Benth.), "A Stink-wood." "Marble-wood." **4.**
Tozeri, F.v.M. (*Pithecolobium grandiflorum*, Benth.) **4** (N).
Hendersoni, F.v.M., "Nuggum-nuggum." **4** (N).
Muelleriana, Maiden and Baker. **4** (N).

Saxifrageæ—
Argophyllum Lejourdani, F.v.M. **4** (N).
nullumense, R. T. Baker. **4** (N).
Abrophyllum ornans, Hook. f. **4.**
Cuttsia viburnea, F.v.M. **4.** (N).
Quintinia Sieberi, DC., "Opossum Wood." **4, 5.**
Verdonii, F.v.M. **4** (N).
Polyosma Cunninghamii, J. J. Benn., "Feather Wood." **4.**
Anopterus Macleayanus, F.v.M. **4** (N).
Callicoma serratifolia, Andr., "Black Wattle" (of the earliest settlers); "Tdjerruing." **3, 4, 5.**
Ceratopetalum gummiferum, Sm., "Christmas Tree." **4.**
*apetalum, D. Don, "Coach Wood." **4.**
Schizomeria ovata, D. Don., "Crab Apple," "White Cherry." **4, 6.**
Ackama Muelleri, Benth. (*Weinmannia paniculosa*, F.v.M.), "Corkwood." **4.**
Weinmannia lachnocarpa, F.v.M., "Marrara," "Brush Redwood." **4** (N).
rubifolia, Benth., "A Marrara." **4** (N).
Geissois Benthami, F.v.M. (*Weinmannia Benthami*), "A Marrara." **4** (N).
Davidsonia pruriens, F.v.M., var. Jerseyana, F.v.M. and Maiden. "Davidson's Plum" **4** (N).

Rosaceæ—
Eucryphia Moorei, F.v.M. **3, 4, 6.**

Rhizophoreæ—
Rhizophora mucronata, Lam., "A Mangrove." **2** (N).

Myrtaceæ—
Leptospermum lævigatum, F.v.M. **1.**
Callistemon coccineus F.v.M, "Red Bottle Brush." **3.**
salignus, DC., "White Bottle Brush." **3.**
Melaleuca pauciflora, Turcz. **3, 4.**
linariifolia, Sm., "Narrow-leaved Tea-tree." **3, 5.**
*Leucadendron, Linn., "Broad-leaved Tea-tree." **1, 2.**
genistifolia, Sm. **3, 5.**
styphelioides, Sm., "Prickly Tea-tree." **3, 5.**
Angophora subvelutina, F.v.M., "Rough-barked Apple (Broad-leaved)." **3, 5, 8.**
intermedia, DC., "Rough-barked Apple (Narrow-leaved)." **3, 5, 8.**
var. melanoxylon (A. *melanoxylon*, R. T. Baker). **10.**
*lanceolata, Cav., "Smooth-barked Apple." **5, 6, 9.**
*†Eucalyptus stellulata, Sieb., "Black Sally." **6, 7, 8.**
*coriacea, A. Cunn., (*E. pauciflora*, Sieb.) "White or Cabbage Gum." **6, 7, 8.**
var. alpina, "Snow Gum." **7.**
vitrea, R. T. Baker, "A Messmate." **6, 8.**
*dives, Schauer, "Broad-leaved Peppermint." **6, 9.**
Andrewsi, Maiden, "New England Peppermint." **6.**
*regnans, F.v.M., "Giant Peppermint." **6.**
*amygdalina, Labill., "A Peppermint," "Narrow-leaved Peppermint." **6.**
*numerosa, Maiden, "River White Gum." **3, 6.**
virgata, Sieb. (the large form). **5, 6.**
var. fraxinoides, Maiden (*E. fraxinoides*, Deane and Maiden). **6.**
var. altior, Deane and Maiden (*E. oreades*, R. T. Baker) "Mountain Ash." **6.**
Planchoniana, F.v.M. **1.**
Sieberiana, F.v.M., "Mountain Ash." **5, 6.**
hæmastoma, Sm., "White or Scribbly Gum" (also var. *micrantha*). **1, 5, 6.**
pilularis, Sm., "Blackbutt." **1, 5.**
Muelleriana, Howitt, "Yellow Stringybark." **1, 5, 6.**
eugenioides, Sieb., "Stringybark." **1, 5, 6.**
capitellata, Sm., "Stringybark." **1, 5, 6.**
macrorrhyncha, F.v.M., "Red Stringybark." **6.**

† This list of Eucalypts is not a complete list of all the New South Wales species, but only of those which attain tree size. The genus is under revision, and it is probable that species may be added to the present list.

Myrtaceæ—*continued.*

*†Eucalyptus obliqua, L'Herit., "Messmate." **6.**
var. alpina, Maiden (*E. delegatensis*, R. T. Baker), "Mountain Ash." **7.**
piperita, Sm., "Peppermint." **1, 5, 6.**
Consideniana, Maiden. **1, 5, 6.**
acmenioides, Schauer, "White Mahogany," **1, 5.**
umbra, R. T. Baker, "White Mahogany." **1, 5.**
microcorys, F.v.M., "Tallow-wood." **4, 5.**
microtheca, F.v.M., "Coolabah," **9, 10.**
polyanthemos, Schauer, "Red Box or Slaty Gum." **6, 9.**
Rudderi, Maiden, "Coast Red Box." **1, 5.**
bicolor, A. Cunn., (*E. largiflorens*, F.v.M.) "Black or Flooded Box." **9,10.**
odorata, Behr., "South Australian Peppermint." **9, 10.**
cajuputea, F.v.M. **10.**
acacioides, A. Cunn. **9, 10.**
fasciculosa, F.v.M., "Western Red Box." **9, 10.**
*paniculata, Sm., "White or Grey Ironbark." **5, 6.**
crebra, F.v.M., "Narrow-leaved Red Ironbark." **5, 6, 9.**
melanophloia, F.v.M., "Silver-leaved Ironbark." **6, 9.**
Boormani, Deane and Maiden, "Black Box." **5.**
siderophloia, Benth., "Broad-leaved Red Ironbark." **5.**
var. glauca, Deane and Maiden, "Blue-leaved Ironbark." **9.**
*sideroxylon, A. Cunn., "The Mugga: A Red Ironbark." **6, 9.**
Caleyi, Maiden, "Red Ironbark." **6, 9.**
affinis, Deane and Maiden. **9.**
*hemiphloia, F.v.M., "Grey Box." **5.**
var. albens, F.v.M., "White Box." **9.**
var. microcarpa, Maiden, "Small-fruited Box." **9.**
Woollsiana, R. T. Baker, "Narrow-leaved Box." **9, 10.**
*melliodora, A. Cunn., "Yellow Box." **7, 9.**
Bosistoana, F.v.M., "South Coast Red Box." **5, 6.**
Baueriana, Schauer, "Blue Box." **6.**
var. conica, Maiden (*E. conica*, Deane and Maiden), "Fuzzy Box." **9.**
populifolia, Hook., "Bimbil Box." **9, 10.**
Behriana, F.v.M., "Mallee." **9.**
ochrophloia, F.v.M., "Napunyah." **10.**
oleosa, F.v.M., "Red Mallee." **10.**
Cambagei, Deane and Maiden, "Bundy." **6, 9.**
*goniocalyx, F.v.M., "Mountain Gum." **4, 6.**
globulus, Labill., "Tasmanian Blue Gum." **6, 7.**
Maideni, F.v.M., "Southern Blue Gum." **5, 6.**
*longifolia, Link and Otto, "Woolly-butt." **5.**
robusta, Sm., "Swamp Mahogany." **1.**
*saligna, Sm., "Coast Blue Gum" or "Flooded Gum." **3, 4, 5.**
var. botryoides, Maiden, (*E. botryoides*, Sm.) "Bangalay." **1.**
Deanei, Maiden, "Broad-leaved Blue Gum." **6.**
Dunnii, Maiden, "Macpherson Range White Gum." **4.**
Stuartiana, F.v.M., "Apple," "White Peppermint." **6.**
var. parviflora, Deane and Maiden (*E. angophoroides*, R. T. Baker). **6.**
Banksii, Maiden, "Tenterfield Woolly-butt." **6.**
quadrangulata, Deane and Maiden, "A Box." **6.**
pulverulenta, Sims, "Argyle Apple." **5, 6.**
nova-anglica, Deane and Maiden, "Black Peppermint." **6.**
acaciæformis, Deane and Maiden, "Grey Peppermint." **6.**
Macarthuri, Deane and Maiden, "Camden Wolly-butt." **3, 6.**
aggregata, Deane and Maiden, "Black or Flooded Gum." **3, 6.**
Gunnii, Hook. f., "Cider Gum." **7.**
var. acervula, Deane and Maiden, "Yellow Gum." **3, 6.**
var. ovata, Deane and Maiden, "Swamp Gum." **3, 6.**
var. rubida, Maiden, "Candle-bark." **6.**
var. maculosa, Maiden, "Mountain Spotted Gum." **6.**

Myrtaceæ—*continued.*

*†Eucalyptus scoparia, Maiden, " Wallangarra White Gum." **6.**
viminalis, Labill., " Ribbony Gum." **3, 6.**
Smithii, R. T. Baker, " White Top." **6.**
tesselaris, F.v.M., " Carbeen." **9.**
*resinifera, Sm., " Red Mahogany." **5, 6.**
var. grandiflora, Benth. **5.**
*punctata, DC., " A Grey Gum." **5, 6.**
var. grandiflora, Deane and Maiden. **5.**
propinqua, Deane and Maiden, " Small-fruited Grey Gum." **5, 6.**
Kirtoniana, F.v.M. (*E. patentinervis*, R. T. Baker), " A Mahogany." **1.**
rostrata, Schlecht., " River Red Gum." **3, 9, 10.**
Seeana, Maiden, " Stone Gum." **5.**
Morrisii, R. T. Baker (? *E. exserta*, F.v.M.) **9.**
*tereticornis, Sm., " The Forest Red Gum." **5.**
var. dealbata, Deane and Maiden, " Inland Red Gum." **6, 9.**
squamosa, Deane and Maiden, " Scaly-barked Red Gum." **5, 6.**
amplifolia, Naudin, " Swamp Red Gum." **3, 6.**
Bancrofti, Maiden, " Orange Gum." **5, 6.**
Baileyana, F.v.M. **6.**
*corymbosa, Sm., " The Bloodwood." **5, 6.**
terminalis, F.v.M. (? *E. intermedia*, R. T. Baker), " Pale Bloodwood." **5, 9, 10.**
trachyphloia, F.v.M., " White Bloodwood." **9.**
eximia, Schauer, " Yellow Bloodwood." **5, 6.**
*maculata, Hook., " Spotted Gum." **5, 6.**
Tristania neriifolia, R.Br., " Narrow-leaved Water Gum." **3, 4.**
suaveolens, Sm., " Swamp Mahogany." **4, 8.**
*conferta, R.Br., " Brush Box." **3, 4** (N).
laurina, R.Br., " Water Gum." **3, 4.**
*Metrosideros glomulifera, Sm. (*Syncarpia laurifolia*, Ten.), " Turpentine Tree." **4, 5, 6, 8.**
leptopetala, F.v.M. (*Syncarpia leptopetala*, F.v.M.), " Brush Turpentine." **4** (N).
Backhousia myrtifolia, Hook. and Harv., " Grey Myrtle." **3, 4, 5.**
sciadophora, F.v.M. **3, 4** (N).
Rhodomyrtus psidioides, Benth. **3, 4** (N).
Myrtus rhytisperma, F.v.M. **4** (N).
acmenioides, F.v.M. **4** (N).
Rhodamnia trinervia, Blume, " Three-veined Myrtle." **4** (N).
var. glabra, Maiden and Betche. **4** (N).
argentea, Benth., " Silver Myrtle." **4.**
Decaspermum paniculatum, Baill. (*Nelitris paniculata*, Lindl.) **3, 4** (N).
Eugenia Smithii, Poir., " Lilly Pilly." **3, 4, 5.**
var. minor, Maiden. **4** (N).
hemilampra, F.v.M. **3, 4** (N), **5.**
Ventenatii, Benth., " Drooping Myrtle." **3, 4** (N), **5.**
Moorei, F.v.M. **3, 4** (N), **5.**
corynantha, F.v.M. **3, 4** (N), **5.**
Luehmanni, F.v.M. (*E. parvifolia*, C. Moore), " Small-leaved Myrtle." **3, 4** (N), **5.**
Hodgkinsoniæ, F.v.M. **3, 4** (N), **5.**
brachyandra, Maiden and Betche (*Memecylon australe*, C. Moore). **3, 4,** (N), **5.**
paniculata, Banks and Sol. (*E. australis*, Wendl.; *E. myrtifolia*, Sims), " Brush Cherry." **3, 4, 5.**
cyanocarpa, F.v.M., " Blue Myrtle." **3, 4, 5.**

Araliaceæ—

Panax Murrayi, F.v.M. (*Polyscias Murrayi*, Harms.), " Pencil Cedar." **3, 4.**
*elegans, C. Moore and F.v.M., " Black Pencil Cedar." **3, 4.**

Cornaceæ—

Marlea vitiensis, Benth. (*Stylidium vitiense*, F.v.M.), " Northern Musk-tree." **4** (N).

Rubiaceæ—

Ixora Beckleri, Benth. **4** (N).
Hodgkinsonia ovatiflora, F.v.M. **3, 4** (N).
Canthium latifolium, F.v.M., "Wild Lemon." **9, 10.**
lucidum, Hook. and Arnott. **4** (N).
oleifolium, Hook., "Wild Lemon." **9, 10.**
buxifolium, Benth. **4** (N).
vacciniifolium, F.v.M. **4.**
coprosmoides, F.v.M. **4** (N).
Psychotria loniceroides, Sieb. **4.**

Compositæ—

Olearia argophylla, F.v.M., "Musk-tree." **4** (S), **6.**
Bedfordia salicina, DC. (*Senecio Bedfordii*, F.v.M.). **4** (S), **6.**

Epacrideæ—

Monotoca elliptica, R.Br. (*Styphelia elliptica*, Sm.). "Wallang-unda." **1, 5.**
Trochocarpa laurina, R.Br., "Barranduna." **4, 6.**

Myrsinaceæ—

Rapanea subsessilis, Mez. (*Myrsine subsessilis*, F.v.M.). **4**
Howittiana, Mez. (*Myrsine Howittiana*, F.v.M.). **4.**
variabilis, Mez. (*Myrsine variabilis*, R. Br.). **4.**
Aegiceras majus, Gærtn (*A. corniculatum*, Blanco). **1, 2.**

Sapotaceæ—

Niemeyera prunifera, F.v.M. (*Chrysophyllum pruniferum*, F.v.M.). **4** (N).
Amorphospermum antilogum, F.v.M. **4** (N).
Sideroxylon Richardi, F.v.M. (*Achras laurifolia*, F.v.M.). **4.**
*australe, Benth. et Hook. f. (*Achras australis*, R. Br.), "Black Apple." **4.**
myrsinoides, Benth. et Hook. f. (*Achras myrsinoides*, A. Cunn.) **4** (N).
Hormogyne cotinifolia, DC. **4** (N).

Ebenaceæ—

Diospyros mabacea, F.v.M. (*Cargillia mabacea*, F.v.M.) **4** (N).
Cargillia, F.v.M. (*Cargillia australis*, R. Br.), "Booreerra," "Black Plum." **4.**
pentamera, F.v.M. (*Cargillia pentamera*, F.v.M.), "Caarambool," "Gray Plum." **4.**
Maba fasciculosa, F.v.M. **4.**
sericocarpa, F.v.M. **4.**

Styraceæ—

Symplocos spicata, Roxb., var. australis, Benth. (*S. Stawellii*, F.v.M.) **4** (N).
Thwaitesii, F.v.M. **4** (N).

Jasminaceæ—

Olea paniculata, R.Br., "Marble-wood." **4** (N).
Notelæa ovata, R.Br., "Dunga-runga," "Native Olive." **5.**
longifolia, Vent., "Coobagum," "Native Olive." **5, 6.**
microcarpa, R.Br. **5, 6.**
ligustrina, Vent., "Ironwood," "Silkwood." **5.**

Apocynaceæ—

Ochrosia Moorei, F.v.M. **4** (N).
Tabernæmontana orientalis, R.Br., var. angustisepala, Benth., "Bitter-bark." **4** (N).
*Alstonia constricta, F.v.M., "A Bitter Bark." **4** (N), **9, 10.**

Loganiaceæ—

Strychnos psilosperma, F.v.M. **4** (N).

Boraginaceæ—

Ehretia acuminata, R.Br., "Brown Cedar." **4.**
membranifolia, R.Br. **4** (N), **9.**

Solanaceæ—

Duboisia myoporoides, R.Br., "Cork-wood." **4.**

Myoporaceæ—

Myoporum tenuifolium, Forst: (*M. acuminatum* R.Br.). **1, 5.**
serratum, R.Br. (M. insulare, R.Br), "Blue-berry Tree." **1** (S).
deserti, A. Cunn. **9, 10.**
platycarpum, R.Br., "Sugar-tree," "Dogwood," **9, 10.**
Eremophila oppositifolia, R.Br. **10.**
Mitchelli, Benth., "Buddtha," "Budda," "Sandalwood." **10.**
bignoniflora, F.v.M. **10.**
latifolia, F.v.M. **10.**

Verbenaceæ—

Clerodendron tomentosum, R.Br. **4.**
*Gmelina Leichhardtii, F.v.M., "Beech," "White Beech." **4** (N).
Vitex trifolia, Linn. **1.**
lignum-vitæ, A. Cunn., "Lignum-vitæ," "Black Satin-wood." **1, 4** (N).
glabrata, R.Br. **1.**
Avicennia officinalis, Linn., "White Mangrove." **1, 2.**

Labiatæ—

Prostanthera lasianthos, Labill., "Mint-tree." **3, 4, 6.**

Phytolaccaceæ—

Codonocarpus australis, A. Cunn., "Coastal Horse-radish Tree." **4** (N).
cotinifolius, F.v.M., "Western Horse-radish Tree." **9, 10.**

Nyctaginaceæ—

Pisonia Brunoniana, Endl., "Bird-lime." **4.**

Monimiaceæ—

Hedycarya angustifolia, A. Cunn. (*H. Cunninghamii*, Tul.), "Wild Mulberry." **4.**
Tetrasynandra pubescens, Perk. (*Kibara pubescens*, Benth.) **4** (N).
longipes, Perk. (*Kibara longipes*, Benth.) **4** (N).
Wilkiea macrophylla, A. DC. (*Kibara macrophylla*, Benth.) **4.**
Daphnandra micrantha, Benth., "Yellow-wood." **4** (N).
tenuipes, Perk. **4** (N).
Atherosperma moschatum, Labill., "Victorian Sassafras." **4** (S).
*Doryphora sassafras, Endl., "N.S.W. Sassafras." **4.**

Lauraceæ—

Cryptocarya patentinervis, F.v.M. **4** (N).
*obovata, R.Br., "She-Beech," "Sycamore." **4** (N).
glaucescens, R.Br., "Black Pine," "Brown Beech." **4.**
microneura, Meissn. (*C. glaucescens*, R.Br., var. *microneura*, Meissn.) **4.**
triplinervis, R.Br. **4** (N).
Meissneri, F.v.M. **4** (N).
australis, Benth., "Grey Sassafras." **4** (N).
Beilschmiedia obtusifolia, Benth. (*Nesodaphne obtusifolia*, Benth.) **4** (N).
Endiandra discolor, Benth., "Murrogun." **4** (N).
Sieberi, Nees, "Cork-wood." **4.**
globosa, Maiden and Betche. **4** (N).
virens, F.v.M. **4** (N).
Muelleri, Meissn. **4** (N).
pubens, Meissn. **4** (N).
var. glabriflora, Benth. **4** (N).
Cinnamomum Oliveri, Bail., "Queensland Sassafras." **4** (N).
virens, R. T. Baker. **4** (N).
Litsea dealbata, Nees. **4.**
var. rufa, Benth. **4** (N).
Litsea hexanthus, Juss. (*Tetranthera ferruginea*, R.Br.), "Ugaulbie." **4** (N).
reticulata, Benth. (*Tetranthera reticulata*, Meissn.), "Bolly Gum." **4** (N).

Proteaceæ—

Persoonia salicina, Pers. **5, 6.**
lucida, R.Br. **5, 6.**
mollis, R.Br. **5, 6.**
Helicia glabriflora, F.v.M. **4** (N).
ferruginea, F.v.M. **4.**
Youngiana, F.v.M. **4** (N).

Proteaceæ—*continued.*

*Macadamia ternifolia, F.v.M., "Queensland Nut." **4** (N).
præalta, Bail. (*Helicia prœalta*, F.v.M.), "Possum Nut." **4** (N).
Hicksbeachia pinnatifida, F.v.M. **4** (N).
Xylomelum pyriforme, Sm., "Native Pear." **5, 6.**
Orites excelsa, R.Br., "Prickly Ash," "Silky Oak." **4** (N).
*Grevillea robusta, A. Cunn., "Silky Oak." **4** (N).
striata, R.Br., "Beef-wood." **9, 10.**
Hilliana, F.v.M., "Silky Oak," "White Yiel Yiel." **4** (N).
Hakea lorea, R.Br., "A Western Cork-tree." **10.**
saligna, R.Br. **5, 6.**
leucoptera, R.Br., "Needle-wood." **9, 10.**
Stenocarpus sinuatus, Endl., "Fire-tree." **4** (N).
*salignus, R.Br., "A Beef-wood." **4.**
Banksia ericifolia, Linn., "Small-leaved Honeysuckle." **5, 6.**
spinulosa, Sm. **5, 6.**
marginata, Cav., "Honeysuckle." **5, 6, 8.**
*integrifolia, Linn., "White Honeysuckle." **1, 5.**
serrata, Linn., "Red Honeysuckle." **1, 5, 6.**

Euphorbiaceæ—

Actephila grandifolia, Baill. **4** (N).
Mooreana, Baill. **4** (N).
Petalostigma quadriloculare, F.v.M., and var. glabrescens, "Wild Quince," Benth. **4** (N).
Phyllanthus Ferdinandi, Muell. Arg. **1, 2.**
var. minor, Benth. **4** (N).
supra-axillaris, F.v.M. **4** (N).
Hemicyclia australasica, Muell. Arg. **4** (N).
Bridelia exaltata, F.v.M., "Brush Ironbark." **4** (N).
Cleistanthus Cunninghamii, Muell. Arg. **4.**
Croton insularis, Baill., "Native Cascarilla," "Warrel." **4.**
phebalioides, F.v.M., "Native Cascarilla." **4.**
Verreauxii, Baill., "Native Cascarilla." **4.**
acronychioides, F.v.M. **4** (N).
affinis, Maiden and Baker. **4** (N).
Claoxylon australe, Baill. **4.**
var. laxiflora, Benth.
var. dentata, Benth.
Mallotus claoxyloides, Muell. Arg. **4** (N).
philippinensis, Muell. Arg., "Kamala" (of India). **4** (N).
discolor, F.v.M., "Bungaby." **4** (N).
Macaranga tanaria, Muell. Arg., "Tumkullum." **4** (N).
*Baloghia lucida, Endl., "Brush Bloodwood." **4.**
Homalanthus Leschenaultianus, Juss. (*Omalanthus populifolius*, Grah.; *Carumbium populifolium*, Reinw.), "Native Poplar," "Bleeding-heart Tree." **4.**
stillingiifolius, F.v.M. (*Carumbium stillingiæfolium*, Baill.) **4** (N).
Excæcaria agallocha, Linn., "Milky Mangrove." **2, 4** (N).
Dallachyana, Baill. **4** (N).

Urticaceæ—

Celtis paniculata, Planch. **4** (N).
Trema canabina, Lour., var. aspera, F.v.M. (*T. aspera*, Blume). **4.**
var. orientalis, F.v.M. (*T. orientalis*, Blume). **4** (N).
*Aphananthe philippinensis, Planch., "Native Elm." **4.**
Ficus Cunninghamii, Miq. **4** (N).
*Henneana, Miq., "Cedar Fig," "A Deciduous Fig." **1, 4.**
eugenioides, F.v.M. **1, 4.**
Muelleri, Miq. **4.**
*rubiginosa, Desf., "Rusty Fig." **1, 3, 4.**
platypoda, A. Cunn. **1** (N).
macrophylla, Desf., "Moreton Bay Fig." **4** (N).
Bellingeri, C. Moore, "Bellinger Fig." **4** (N).
stenocarpa, F.v.M. **4** (N).
scabra, G. Forst. (*F. aspera*, Forst.), "Rough-leaved Fig." **4.**
var. subglabra, Benth. **4.**
opposita, Miq. **4** (N).

Urticaceæ—*continued.*

Pseudomorus Brunoniana, Bureau, " Lagaulbie," " Whalebone Tree." **4.**
Laportea gigas, Wedd., " Giant Nettle." **4.**
photiniphylla, Wedd., " Small-leaved Nettle." **4** (N).
moroides, Wedd. **4** (N).

Casuarinaceæ—

*Casuarina stricta, Ait. (*C. quadrivalvis*, Labill.), " Drooping She-Oak." **1, 9, 10**
*lepidophloia, F.v.M. (*C. Cambagei*, R. T. Baker), " Belah." **9, 10.**
*Luehmanni, R. T. Baker, " Bull Oak." **8, 9.**
*glauca, Sieb., " Swamp Oak." **2.**
*suberosa, Otto. and Dietr., " Black She-oak." **5, 6.**
*Cunninghamiana, Miq., " River Oak." **3.**
*inophloia, F.v.M. and Bailey, " Thready-barked Oak." **6** (N).
*torulosa, Ait., " Forest Oak." **5, 6.**

Cupuliferæ—

Fagus Moorei, F.v.M., " Negro-head Beech." **6** (N).

Santalaceæ—

*Fusanus acuminatus, R.Br. (*Santalum acuminatum*, A. DC.), " Quandong." **9, 10.**
persicarius, F.v.M. (*Santalum persicarium*, F.v.M.) **9, 10.**
Exocarpus latifolia, R.Br., " Broad-leaved Cherry." **4** (N).
cupressiformis, Labill., " Native Cherry." **5, 6.**

Coniferæ—

*Callitris Macleayana, F.v.M., " Stringybark Pine," " Port Macquarie Pine." **4** (N), **5.**
*verrucosa, R.Br., " Mallee Pine." **9, 10.**
*robusta, R.Br., " White or Common Pine." **9, 10.**
*columellaris, F.v.M. **1** (N).
*Muelleri, Benth. and Hook. f., " Cypress Pine." **6.**
*propinqua, R.Br. **9.**
*calcarata, R.Br., " Black Pine." **9, 10.**
*cupressiformis, Vent., " Port Jackson Pine." **5.**
Araucaria Cunninghamii, Ait., " Richmond River or Hoop Pine." **4** (N).
*Podocarpus elata, R.Br., " Brown Pine." " She Pine." **3, 4.**

Palmacæ—

Archontophoenix Cunninghamiana, Wendl. (Ptychosperma Cunninghamii, Wendl.). " Bangalow Palm." **4.**
Livistona australis, Mart., " Cabbage Palm." **4.**

Pandanaceæ—

Pandanus pedunculatus, R.Br., " Screw Pine." **1** (N).

Lecture on Dairying.

Mr. O'Callaghan at Tamworth.

Mr. M. A. O'Callaghan, Government Dairy Expert, delivered a lecture on dairying in the Oddfellows' Hall in the afternoon. Mr. W. M. Wilson, President of the Tamworth Agricultural Association, occupied the chair, and there were about forty persons present, the great majority being dairy farmers.

Mr. O'Callaghan said that in a district where dairying was a new industry, he was often asked whether it was likely to be overdone. Well, a few figures would give an idea of the magnitude of the industry, and they might be surprised to hear that the output of wheat had to take secondary place to the production of milk throughout the world. In 1903 the value of wheat produced throughout the world was £520,000,000, while the value of milk was about £5,000,000 more. The figures for Asia in regard to milk are not included, as they are not reliable; but at any rate the sum mentioned did not take into account the value of the annual calf produced by each cow. In 1864, England imported dairy products to the value of £7,000,000 sterling. Forty years later, namely, in 1904, their value was £31,000,000. That amount was paid away by Great Britain to foreigners for the most part, of which £21,000,000 was for butter. In 1896 this State sent £100,000 worth of butter to England; last year we sent about £800,000—an increase of seven-fold. Denmark, with its small area, exported £9,000,000 worth of butter.

Our Opportunity.

How is it that there is room for new countries, such as Australia, Siberia, Canada, and the Argentine to come into the dairy produce market? This could be attributed to several things. There was the great increase of consumption, for instance, which is caused by the increased wealth of the people and the increased population, by the decrease in retail price of butter, the improved butter which was put upon the market, better trading facilities, greater knowledge among the people of the food value of butter, and the better control of such products as margarine. An interesting feature of the position was that thickly populated countries which were once exporters are now importing from the new countries. Ten years ago Germany was a large exporter of butter; now, her manufactories having largely increased, she is an importer instead. The manufactures attracted population to the cities, thus making labour in the country dearer, which choked out the dairying industry. It was the same with other countries, and this was going to be the history of the United States too, which country will probably take much of Canada's surplus. Scientific investigation had made the dairying industry possible in this country; thus we could send butter long distances to a market. He thought he had answered the question as to whether the industry was likely to be overdone. He thought it was most improbable, more especially with countries south of the equator, whose summer corresponds with the European winter—the time when the price is high. We are on velvet in Australia in that regard, and because our cost of production was so much less.

How to Commence.

If he knew the district more intimately, he could go into greater details as to the chief rules for successfully commencing the industry. The first consideration was undoubtedly the rainfall. No matter how rich the land might be, a good rainfall is essential. The lowest under any circumstances must not be less than 25 inches; with 30 inches which we had here, a man had to use his brains to make a success; with 50 inches he should be successful without any difficulty. Cows must have a plentiful supply of good water, a running stream if possible—certain good clean water that the animal would taste with pleasure in consuming. On a hot day a cow will take 8 or 10 gallons of water, as her product contained the greatest percentage of water, and she wanted much for her bodily needs. Dams, if used, must be protected from filth, which otherwise the cows convey on their skins and deposit in the milk-pail. Then provision must be made for green fodder, or at any rate a good substitute. In winter time the farmer should have ensilage if he wants to make the most of his industry. No matter how good his hay might be, and lucerne hay was very good, there must be some succulent food. Fodder could be stored in silos in its green state, either by tub, or stack, or pit.

About the Herd.

To come to the class of cow. In buying a cow, a man thinks he pays a big price if he gives £10 for her; but he would have to give double as much in England, where cows produce no more. The £10 would be repaid by the cow in one year if she were any good, and of course a buyer would have to remember that a seller did not sell his best cows as a general thing. If a young man wanted to make an economical successful beginning, he would advise him to go to a dairying district, buy fifty heifers from 1 year to 18 months old at (say) 70s. to 80s. If they were secured a year before he intended to commence, by the time he was ready they would be in milk, and would cost £8 to £10 to buy then. He would have no pick of his herd, but he could cull out (say) twenty of the fifty in the first year. A pure-bred bull should be chosen. The future of a herd depends upon the bull, and a pure-bred animal was essential, as he must be expected to reproduce his own good points, a thing which a cross-bred bull, however good himself, could not be trusted to do. This great lesson had been taught to the dairy farmers by the introduction of the Government bulls. No man must say he cannot afford a good bull, for there is nothing in keeping a herd that will not keep him. A merchant in his business charges the cost of producing the article before estimating his profit; so should a dairyman charge the cost of labour (even if done by his own family), of food, and other expenses, and see what his cow turns him in. Take three cows as an example, and assume that the annual cost of attending each was £5. The first might produce 100 lb. of butter, which, sold at 1s., would turn in £5 a year. That cow is not worth keeping; 100 such cows would not be worth milking. A second cow might produce 125 lb. of butter. She would be worth 25s. per year to her owner. Another might produce 150 lb. One of her sort would be better than two of class No. 2. Of course his estimate of production was very low, but he wanted them to realise the point he was making, that a good cow mus tbe secured. Success could only be achieved by bringing a herd up to a certain standard, and the bull is the animal that grades up a dairy herd. Do not buy a cheap bull; a good one gets fifty calves a year. Say half of them are heifers; you keep him (say) three years; he thus produces seventy-five heifers. Put seventy-five good heifers against seventy-five bad ones and you see the difference. Therefore, whether it costs £1 or £10 more, get a good bull; it is the greatest economy. Rather than use a bad bull, farmers should beg, borrow, or steal a good one. Wool men do not mind how much in reason they pay for a ram to improve their flock; so should a dairyman regard his bull.

Rearing the Calves.

The next matter is in regard to rearing the calves. No matter how good they are, they might be spoilt as a milk-producing animal unless properly reared. The tendency of a calf is to lay on flesh. There is no necessity to bring a calf up on a cow. Two bad results are liable to follow if it is done,—it gives a tendency to beef, and the milk of the cow is always poorer. That is a matter they could prove for themselves, and the point had been tested hundreds of times. When born, some leave the calf on the cow for twelve or twenty-four hours. At many dairies they take the calf as soon as they notice it; at others they leave them on for two or three days. This method has its good points. The main advantage is, that it is thought that thereby the tendency to milk fever is obviated. He preferred, on the whole, to take the calf away as soon as it is noticed. Give it its mother's milk for the first week, as the milk of a newly-calved cow is of special quality, containing certain medicinal properties which are good for the young calf. The calf should have new milk for the first three weeks. The amount could be lessened gradually after two weeks, and substitute separated milk. Any sudden change brings about digestive troubles, and is one of the chief causes of scours. At the end of the fourth week the calf need be given no new milk, but something must be substituted for the fat which has been taken from the milk. That is an easy matter. Boiled crushed maize, fed with the milk, is good and cheap; but linseed oil cake is best. Two ounces daily, mixed with the milk, gradually being increased to 4 oz. as the calf grows; dissolve in hot water and mix with the milk. Always feed the milk warm. The cow's milk is at a temperature of 100 degrees, and the thing is to follow nature as closely as possible. The milk must be given under clean conditions

It is not good to feed from a common trough unless the calves are graded. Nothing goes bad more quickly than milk, and any left in a trough turns bad, and contaminates the fresh lot when put in. It acts as a starter for the new lot, which might not turn bad there and then, but will do so in the calf's stomach with injurious results. At four months—or, anyhow, six months—old, the calf will be fit to turn out. In the meantime, it would have learned to graze, and therefore good, clean, sunny paddocks should always be provided, and the house they use absolutely clean. If the calf-scour germ once gets under the boards of the calf pen floor, you will have it every year until you shift the pen. The young heifer will be turned out from the time she is six months old till eighteen months, and then all depends upon her treatment when being brought into milk. If the heifer is on the beefy side, she should be sent to the bull younger than otherwise, as this is the only way to develop the milk-producing tendency, and to counteract the beefy tendency. The dairyman is frightened of stunting the cow by having her in calf too young, but there is nothing else for it if she is of a beefy tendency. The only way then is to give the young cow four or five months' rest after dropping her calf before putting her to the bull again. Thus she gets a chance to develop, and at the same time a start has been made in developing her milking qualities. It is a great mistake to milk a heifer for two months and then turn her out. She should be milked just as a grown cow.

Breeds.

The dairyman need not have pure-bred cows to commence successfully. His type will be developed by the bull he keeps in a couple of generations. A cross-bred cow will yield as much milk as a pure-bred if bred on right lines. Each dairyman should make his selection to suit his circumstances. It would be folly to try to keep Shorthorns on poor land, and it would be unwise to keep the small breeds on good land if you wanted to make something out of your steers. If a man has a good run, and wants to get something for his steers, his attention should be confined to three or four breeds—the Shorthorn, the Red Poll, Holstein, and the Kerry. The Shorthorn is an ideal cow if the land is rich, but they are not suitable where plenty of good fodder could not be got without much exertion. The small breeds will forage for themselves. The Red Poll has all the good attributes of the Shorthorn on a smaller scale. It is one of the most valuable of breeds. It is hardier and a greater forager than the Shorthorn, consequently will do on poorer pastures. The Holstein is perhaps the greatest milking breed in the world, having been bred for the milk-pail for 2,000 years. A cross with the Shorthorn gets good steers. The milk is not as rich as the Shorthorn, but it partly makes up for that in giving a larger quantity. The Kerry must not be confused with the small breed, the Dexter-Kerry. The Kerry will cross well with the Shorthorn, and will hold its own anywhere. On light lands, with deficient rainfall, where a regular supply of green fodder is not available, it would be hard to get a better animal; this will be found especially true in New England.

As for Jerseys. Guernseys, and Ayrshires, these small breeds did not give a revenue from steers, and the best thing to do with the bull calf was to knock him on the head. Take the Jersey as a valuable butter breed, with an eye for nothing else. She gives a fair quantity of extremely rich milk. There is no better butter cow in the world. It is a false impression to think they are delicate ; the fact is, that there is no tuberculosis on the Channel Islands, and the United States admit Jerseys without the test. There are two classes of Jerseys. Seeing that so few Jerseys had been imported, he did not know where all the thoroughbred animals come from. (Laughter.) Put a Jersey bull to any class of cow and the progeny will probably be of good colour. He had seen quarter-bred animals shown as pure-bred ; and what could be expected of their progeny than weeds. The proper English Jersey should have plenty of substance. He had seen these seven breeds referred to running together under the same conditions, and the Jerseys were certainly not delicate. They would not stand the cold like Ayrshires or Kerries, however. Crossed with a Shorthorn, the Jersey produces a good calf, but he would not advise crossing with the small breeds.

The Guernsey cow promises to be the most popular breed in New South Wales. Perhaps a thousand years ago the Jerseys and Guernseys were all the same breed ; now they are very different. The Guernsey is larger and coarser, consequently hardier towards the cold. It has been used for draught purposes once, which should account for its size compared with the Jersey. It crosses well with the Shorthorn, Ayrshire, and Holstein.

About Milk and Cream.

Now, to say something about milk and the care of cream. When the milk is drawn from the cow, it is at a temperature of about 100 degrees, and that is the right heat to separate at. Never separate at less than 90 degrees, or there will be a loss of cream. When the cream leaves the separator it must be cooled, and that is why it should be delivered as soon as possible to the factory. The time must come when cream must be delivered daily. It is the only way to make first-class butter, and the farmer would get a better test sample. Stale cream will not supply a good test sample. It is a bad habit to pour your hot cream of one milking into the cold cream of the previous milking. Separate into another vessel, and, when cool, mix and stir thoroughly. Afterwards, the more cream is stirred the better, as a fresh surface is continually being presented to the atmosphere. Some farmers never stir, but allow froth to accumulate on the milk ; nothing is worse, for the cream at the bottom becomes sour, and affects the whole lot. Dairying, except on clean lines, is impossible. A dirty man is an enemy to his district, as his product might mix with others and spoil the whole output. He urged farmers to go in for ensilage. It is the easiest thing in the world to make ; it only wanted cutting at the right stage, and would keep one year or ten. He thanked them for their attentive hearing, and would be very glad to answer any questions.—*Tamworth News.*

An Act for the Protection of Dairymen.

AN ACT IN FORCE IN SOME AMERICAN STATES.

Section 1. All bottles, pipettes, or other measuring glasses used by any person, firm, or corporation, or their agents or employees, at any creamery, butter factory, cheese factory, or condensed milk factory, or elsewhere in this State, in determining by the Babcock test, or by any other test, the value of milk or cream received from different persons or parties at such creameries or factories, shall, before such use, be tested for accuracy of measurement and for accuracy of the per cent. scale marked thereon. Such bottles, pipettes, or measuring glasses shall bear, in marks or characters ineffaceable, the evidence that such test has been made by the authority named in section two of this Act. And no inaccurate bottles, pipettes, or other glasses shall bear such marks or characters.

Section 2. It is hereby made the duty of the Director of the State College Experimental Station, or other competent person designated by him, to test the accuracy of all bottles, pipettes, or other measuring glasses used by persons, firms, or corporations, in this State, buying or pooling milk or cream, or apportioning butter or cheese made from the same, by the contents of butter-fat contained therein. The Director of the Experiment Station, or the person designated by him, shall mark such bottles, pipettes, or other measuring glasses, as are found correct, in marks or characters which cannot be erased, and which marks or characters shall stand as proof that they have been so tested. The Director of the Experiment Station shall receive for such service the actual cost incurred, and no more, the same to be paid by the persons or corporations for whom it is done.

Section 3. Any person, either for himself or in the employ of any other person, firm, or corporation, who manipulates the Babcock test or any other test, whether mechanical or chemical, for the purpose of measuring the contents of butter-fat in milk or cream, for a basis of apportioning the value of such milk or cream, or the butter or cheese made from the same, shall secure a certificate from the superintendent of the dairy school at the State College of Agriculture and Mechanic Arts, that he or she is competent and well qualified to perform such work. The rules and regulations in the application for such certificate, and in the granting of the same, shall be such as the superintendent of that school may arrange, and the fee for issuing a certificate shall in no case exceed one dollar, the same to be paid by the applicant.

Section 4. Whoever uses, or has in his possession with intent to use, at any creamery, butter factory, cheese factory, or condensed milk factory, any sulphuric acid of less than one and eighty-two hundredths of specific gravity in the process known as the Babcock test, or any other test for determining the butter-fat contents of milk or cream shall, on conviction, pay a fine not exceeding twenty-five dollars for the first offence, and for a second offence a sum not exceeding fifty dollars. Any person, firm, or corporation violating the provisions of section one of this Act shall, on conviction, pay a fine not exceeding fifty dollars for the first offence, and for a second offence a sum not exceeding one hundred dollars; and any person violating section three of this Act shall, on conviction, pay a fine not exceeding ten dollars. And it shall be the duty of every inspector of milk, sheriff, deputy sheriff, and constable, to institute complaint against any person or persons violating the within-named provisions of this Act, and on conviction one-half of the fines shall go to the complainant and the balance to the State.

Section 5. This Act shall take effect in six months from the date of its approval.

[Approved March 27, 1895.]

Hogs for Small Farmers.

There is one advantage about pigs that make them emphatically the stock for the poor man or the small farmer, and that is the very quick returns which they afford, by the rapidity with which they increase and come to maturity. A good brood-sow given good treatment, so as to be kept in a good thrifty condition, will farrow two good litters of pigs a year that will run from seven to eight pigs in each litter; and if proper feed and care is given, these may be ready for market by the time they are eight or nine months old at the farthest. No other stock kept on the farm will make so good a return in so short a time. Sheep will come nearest it, but in the same length of time a pig will make double the weight of a lamb.

Another advantage with pigs is that they are marketable from the time they are farrowed until they are fattened for market. A sow with a litter of pigs, and growing pigs three, four, or five months old, will always sell at full market prices; so that the farmer is not obliged to feed them to maturity to get a little money out of them. With a little management pigs may be fattened to sell in the spring and fall, when it is possible to secure the best gain at the lowest cost; and when it is considered that they utilise much on the farm that would otherwise go to waste, it is only in exceptional cases that at least a few cannot be kept on the farm with profit.—*Midland Farmer.*

Farmers' Fowls.

[Continued from page 1214.]

G. BRADSHAW.

Chapter XXV.

Orpingtons for Meat and Eggs.

Having now given an outline of the circumstances which led to the inception of this breed of fowls, and an exhaustive history of its earlier troubles and ultimate triumph amongst poultry-keepers in every part of the world, it now remains to briefly give the attributes which were responsible for its present universality amongst poultry-men.

In England, it now holds pride of place amongst all breeds. Leghorns have many patrons, but fail in numbers in comparison with the breeders of Orpingtons. Plymouth Rocks have many devotees, but do not reach half the number of those who breed the English-made fowl; the runner-up in numbers being the Wyandotte. At the late dairy show in England, where the classes are for birds of the year only—no adults shown—the following are the numbers of exhibits of the principal breeds, which show the Orpington in England, as it is here, the most popular of all breeds, and most numerously exhibited.

There were on exhibition at the Dairy, Andalusians 27, Anconas 29, Brahmas 37, Langshans 37, Faverolles 44, Minorcas 60, Cochins 61, Hamburgs 64, Dorkings 77, Game 116, Plymouth Rocks 123, Leghorns 204, Wyandottes 343, Orpingtons topping the list with 350. Nor was this all, seeing that for the many new varieties of Wyandottes the extraordinary number of 18 classes had to be provided, which showed an average of 19 a class, while the Orpingtons had but 10 classes, being an average of 35 throughout. The largest display of Wyandottes was 32 Silver cockerels and 35 pullets, 35 White cockerels and 40 pullets, and 58 in the two Partridge classes. Coming to the Orpingtons, there were 31 Black cockerels and 45 pullets, 40 White cockerels and 65 pullets, while there were 59 Buff cockerels and the extraordinary number of 70 pullets, showing that the latter colour are still the most found in England. What has brought about this popularity amongst the English fanciers is the simple fact, whether of the Black, Buff, White, or other colour, the birds are of big frames, sturdy growth, easily reared and managed, and, whether kept as egg-producers or carcases for the market, if there were such a thing as best breed, the Orpington fowl would be the one. Beginning with the Blacks, the market man will find them as quick growers as any fowl extant, and if well fed from hatching time, and otherwise wisely managed, the birds will reach 4 lb. each at 16 or 17 weeks old, the pure white skin and tender flesh warranting them a dish fit for any connoisseur in roasts.

Excepting the Blacks, all Orpingtons have white legs, and, should an export trade in poultry products ever become an established fact, there is not a doubt but Orpingtons of the various colours will form the larger bulk of the business. At every table poultry show in England, Orpingtons, principally Buffs and their crosses, have usually secured many chief places in the prize-list, the latest being at the British Dairy Farmers' Association's annual exhibition in October last; in large classes, containing all the breeds but Dorkings, Buff Orpingtons were third and v.h.c., while in a good class of pullets, Lord Windsor won second with Buffs, reserve going to the same breed.

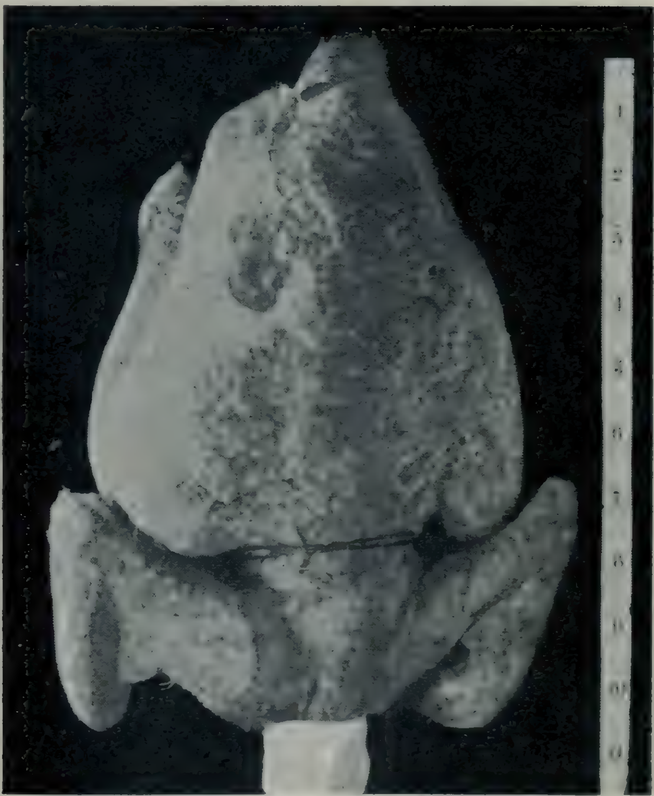
Well-meated Orpington Chicken.

In connection with exporting to London, the following from a London salesman, relative to a shipment of Sydney chickens a few years ago, may be repeated. The birds were largely Orpingtons and their crosses, and were shipped through the Agricultural Department. "The chickens, *ex* 'Australasian,' made 4s. each, and were very fine. Only get them here earlier, and any quantity can be sold at from 4s. to 5s. each with no difficulty. They are the finest frozen chickens that come to our market, and the way they have been killed, dressed, and prepared, is deserving of every praise. Although there have been large quantities of Canadian, Russian, Hungarian, and other varieties, there is no comparison between them and the chickens from Australia."

The chickens referred to were shipped by Messrs. Boyd, of Gosford; Gray, of Paterson; and Hoffman, of Parramatta. They comprised a lot of good-sized birds, carrying plenty of meat, but certainly not the best that have been produced here. The "Australasian's" shipment left Sydney on the 5th May; the birds were sold in the first week of July, which is the tail end of the London season for frozen poultry. Considering that these birds, which could not be classed as the primest, realised so late in the season a price that will clear the breeders here over 6s. per pair, all doubts vanish about there being a profitable outlet in London for Colonial poultry of the right sort at the proper time of the year.

Black Orpington Pullet, showing a long, meaty breast.

As market poultry, Orpingtons have short legs, free from feathers, wide and deep in body, full breast, the frame excellently suited whereon to quickly build meat; and for those who intend going in for breeding poultry for market purposes I can safely recommend this breed as one of the first they should try. In breeding them pure, and properly treated, they make most excellent carcases, and can be as cheaply brought to a marketable stage as any known variety, while for crossing purposes Mr. W. Cook's testimony will be conclusive, wherein he says:—" Cross-breeding in the past has not been looked upon favourably by old-school breeders, whose conservative notions have always hindered progress like this; but in many instances advanced spirits of their generation have indulged in this to a certain extent, and so many crosses have been tried with good results. If I may be permitted to give a piece of personal experience, I may say I have learnt more of the real value of breeds through crossing than by any other means, and it was while crossing that I gained that insight into the characteristics of the various breeds which enabled me to choose out the best varieties with which to build up the various Orpingtons, which are now so popular."



Buff Orpington—Faverolle's Cross 6 months old; weight, 7 lb.

Orpingtons can be bred profitably for the markets, while for those who prefer cross-breeding there are several breeds which can be judiciously used. A Dorking cock, if mated with eight or ten Black, Buff, or any other colour Orpington hens, will make a breeding pen of the very first order. They grow quickly, feather fast, and are in killing condition at almost any age from four months. A short-legged Colonial Game, or Old English Game, cock, if mated with the same number of hens, can also be recommended. The chickens from these will be more plump than the Dorking cross.

Coming to the breed's merits as egg-producers, such is of the very highest order, and despite the fact that it is an acknowledged principle that the best table qualities and an excess of egg-production cannot be found in any breed, Orpingtons go very near to dispel it; and, indeed, had the Buff variety equalled the Blacks at the various laying competitions in this and other States, such would have gone a long way in establishing the Orpington as the best all-round fowl, and the Buffs the best of the several varieties.

Regarding the laying competitions, there is no need to rehearse all the records made; suffice to say that as egg-producers the following figures are incontrovertible. At the second International Laying Competition at the Hawkesbury College, which began on the 1st April, 1903, and continued for three months, out of seventy pens competing, one pen of six black Orpingtons entered the contest at 7½ months of age, and completed the year's work with 1,274 eggs, or almost eighteen dozen for each hen. The contest was both Interstate and International, this pen of New South Wales Black Orpingtons beating every breed and every pen, one excepted, that being Wyandottes; and, had weight of eggs been considered, the Orpingtons would have won, seeing that the eggs weighed 25 oz. to the dozen, as against 24 oz. for the Wyandottes; while, taking all the Black Orpingtons in the competition, bad layers and good, 84 birds in all, they averaged 168 eggs each, or fourteen dozen for each hen, a performance of the highest order, and not responsible to any artificial foods, spices, balanced rations, or other of the now many things guaranteed to make hens lay; the food was of the simplest, and those electing to take up this breed, or any other for that matter, for the purpose of a plentiful egg supply, need not go beyond the simple formula which is embodied in Mr. Thompson's report, as follows:— "The hens have been fed on the simplest diet possible throughout the competition. The morning meal consisted of bran and pollard mash at 7 o'clock. The mash was scalded with liver soup two days a week, and on the other five days it was simply mixed with water, the quantity given being an average of about one Imperial pint per pen, the big eaters taking considerably over a pint, and the small eaters a little under. In the afternoon, between 4 and 5 o'clock, the hens were grain-fed, one pint, more or less according to appetite, of crushed maize, and sometimes wheat. Cut-up liver was given twice a week, at the rate of about 2 oz. per head. Shell grit was always before them, and clean water was given every morning. In the way of green food, rape was fed for three months during the winter, when the grass was withered. For the other nine months, the only green food the hens got was the natural grass in the pens. The rape was fed whole in the leaf, at the rate of a dozen leaves to a pen every second day."

Coming to the later College competition, which commenced when the preceding one closed on the 1st April, 1904, 100 pens competed, and although there was a diminished egg yield in all the breeds from the previous year, Black Orpingtons still held a high position, the 108 birds averaging 159·48, or over thirteen dozen for each hen. The same number of Silver Wyandottes competed, these averaging 145·30 eggs, or a point over twelve dozen eggs each, and although the highest pen of Orpingtons only got fifth place, they were only less than a dozen each below the winner, while there were twelve pens of other pens and varieties lower than the lowest of the Black Orpingtons. As in the previous contest, the highest pen of Black Orpington's eggs weighed 25 oz. to the dozen, as against 24 oz. laid by the winning Wyandottes.

So far as the present 1905 contest has gone, the Orpingtons are again placing beyond the region of doubt their reputation of egg-producers of the highest order, Blacks again being ahead of the Buffs. For the seven months beginning April of the present year, a pen of Blacks have laid over ten dozen each at the Hawkesbury College; while, going to the Rockdale competition, of the fifty lots competing, two pens of Black Orpingtons are leading with over twelve dozen each for the seven months The laying competitions in the other States exactly confirm the experience here, for although but in rare instances have a pen of Orpingtons topped the score, taking them as a breed in every instance, they performed excellently. In the first Victorian contest, which concluded on the 30th April last, a pen of six Black Orpingtons from Wagga laid in the twelve months 1,228 eggs, or over seventeen dozen for each hen, while all the Blacks in the same competition performed just about as they did in this State, namely, about fourteen dozen eggs for each hen, which goes to show that, whether for eggs or meat, or both, of all the new breeds or old, or of whatever inception or nationality, as a farmer's fowl nothing has yet been introduced to this country from England or elsewhere to surpass them.

Chapter XXVI.

Breeding Orpingtons.

When writing on these fowls a number of years ago, I invited and received contributions from a number of its then prominent patrons, and were any testimony desired as to its profitableness, the very fact that in this age of new breeds and varieties the then advocates and breeders of Orpingtons continue doing so still, and what was then said by various writers has been verified by later experience. However, since that time other Orpington enthusiasts, and successful ones, too, have come on the scene, and divided honours with the old-time exhibitors to an extent that, when a leading show now takes place, the good Orpingtons are so numerous that many specimens of sufficient merit to win prizes in the olden days are now left cardless, and, although the bulk of the then prominent successful winners continue to win, at the same time a few of the later recruits are now disputing premiership with those of earlier experience, with the result that the breeder who can win a couple of prizes in the Orpington classes now-a-days is considered lucky indeed.

It need scarcely be said that to now secure show-pen honours, breeders must first secure well-bred stock, and give great thought to the mating, breeding, and rearing, and be thoroughly acquainted with pedigree, strain merits, and defects of the stock birds they use, and then, when all is done, it will be a good season indeed if two or three winners are produced.

The experience of Messrs. Ramsay, Pemell, Butcher, Grantham Farm, and others are already on record, and that of one or two of the newer patrons will now be given; nor has the success of these latter breeders been due to a lengthy purse, thus enabling them to import English prize-winners, but rather the success which has attended their breeding operations is further proof that just as we need not go to other countries for Orpingtons as egg-producers, neither is it necessary to go beyond our own shores for Orpingtons possessing that type and size which is considered essential in producing prize-winners.

Mr. E. Waldron, of North Sydney, is one of the most successful breeders in this State—a frequent prize-winner here and in Victoria,—and supplies hundreds of pounds' worth of stock to other States. Mr. Waldron's Orpingtons have kept him for years, and this is what he said to a representative of the *Sydney Daily Telegraph*:—

"I have been breeding for utility," he says, "for the past ten years, and have kept Black Orpingtons only. I am so satisfied with the results that I have no intention of making a change. For breeding I select close-feathered hens with broad shoulders and good chests. These three points they must have to suit me. A hen should also carry as much of her body in front of her legs as possible. The moment you get a hen that carries a great part of her body behind her legs, she develops fat, makes a poor layer, and her eggs will not give 25 per cent. of chickens. I have bred some very fluffy Cochiny birds, but find that they all develop fat very early, and at twelve months look like very old hens. For laying, breeding, or table, I would not care to keep many of them. On account of the fat and extra fluff, they get credit in the show pen for being low set, and will knock out a close-feathered bird that is actually shorter on the leg. I have proved this with my own birds. I am not a believer in either short or long legs. I like to see a bird with legs in proportion to its body. It is just as easy to breed one as the other. If you want the fluffy type, all you have to do is use a fluffy rooster, and you will always get it; but if you want layers, my advice is choose close-feathered hens, with bodies carried well forward, with broad shoulders, and good full chests."

Another prominent poultry-breeder who, within the past few years has gone in for Black Orpingtons, and with unprecedented success in the time, is Mr. H. Cadell, of Wotonga, Epping. This breeder appropriated the *Daily Telegraph* cup for the most successful Orpington exhibitor at this year's Poultry Club Show, securing two firsts and champion and two seconds in Blacks, and three of the firsts in Buffs, a record hitherto rarely approached, and as showing how this success was attained, and as a guide to those not already in the know, Mr. Cadell contributes the following, entitled "How to Breed Prize-Winners."

"In mating Black Orpingtons, the colour question is not so acute as in their younger relations, the Buffs; but to obtain the beetle-green so essential in the variety, care must be used in choosing a male to see that he is green all over and down on to the soft feathers covering the thighs, and fluff should also be green; he must be short on leg, full and round in breast, and dark in eye, in fact, a black or bull eye is preferable to the standard 'black pupil and dark brown iris.' In a stock cock, back short, broad at saddle, tail full and flowing—if carried a bit high, do not discard an otherwise typical cock, as a bird showing this fault is usually the sire of very short-backed progeny,—a neat head, clean-cut comb, and, although he may not prove a show-pen champion, his stock, if mated as I suggest, will be. Two years ago I purchased a cockerel at the Royal that could only get commended, giving £10 10s. for him, the winner going for £7 7s. The fowl I bought was a wonderfully blocky, large-chested fellow, and in choosing mates for him I went for short-legged, roomy hens, black in eye; the cockerel failed here, a couple in the pen showing an ample cushion, to get broad backs into the cockerels, and also to keep the tails moderate in size, with abundance of side hangers, and full saddles. The balance of the hens were tighter in feather, neat heads, and very deep in front as well as behind, depth being needed in a hen to give ample room for the 'egg department,' as in a heavy milking cow. Each hen was moved to the pen after careful study and with a definite object, all the while keeping in view the pedigree of each hen. A record of over forty-eight firsts, two silver cups, and numerous other awards for stock from this pen in New South Wales, Victoria, Western Australia, Tasmania, and New Zealand, all won at leading shows, is a guarantee of their show quality, and a pen of six exhibition pullets have laid from being mated end of July to end of October, and not one broody, speaks for them as farmers' utility fowls. I would strongly urge buyers to give more attention to pedigree if wishing to buy to show; and even after all the almost hysterical stuff one reads of so-and-so's marvellous egg-laying strain, a little quiet inquiry will usually prick that bubble, and one finds so-and-so's bred-to-lay strain are the culls from a show fancier's yard. An experienced breeder, who has a few years' show-pen successes to back him, is always more reliable than one of mushroom growth, and even the latter is away ahead of the dealer. Do not expect champions and quite perfect specimens; the former are always in demand at tall figures, while the latter have not been seen yet, although some point-judging cranks have scored fowls as high as 98½ out of a possible 100 at Sydney shows.

"While calling the Black Orpington a grand farmer's fowl, and by farmer I include all dwellers on the land, I think in a couple of ways the younger variety of the Orpington, *i.e.*, the Buff, has a pull over the Black. For eating purposes I place the Buff an easy first, while the colour of the stub feathers, and there are always a percentage of these that remain, does not disfigure the carcase like the Black ones. I have found they more readily fatten, and put on more breast meat; then, by the poulterer, the white leg is much preferred. As Winter layers of nice tinted eggs, they run away from the Blacks, and as all my surplus eggs go to the leading grocers of Sydney, where each lot are weighed, I have never had a word about the egg being under weight, while their tendency to become broody early I consider their greatest point. During the past season I have raised about 500 chickens, about 400 being hatched by hens, and out of all I have set, but five were Blacks, and to a farmer early sitters are valuable, as early hatching means Winter eggs the following year, as well as meaty saleable cockerels by Christmas. When the Buffs are not required as sitters, if put away first time found on the nest after dark, they soon come laying again. As mothers they are unequalled, and many hens lay with chicks three to four weeks old, and still brood the chicks. If I had to choose one variety for commercial purposes, I would go straight and keep Buff Orpingtons only.

"As exhibition fowls they are very hard to breed to the one even shade of rich buff all over; but, after five years' careful mating, I find a much greater percentage of the chickens are coming true to colour, less black and white in tail and flights, and less leggy. To raise Buffs for show, careful inbreeding is an absolute essential, and if buying for producing show birds, ware the yard that is always introducing fresh blood. Just watch the show-pen, and though such haphazard breeders may occasionally score, the scientific breeder will average better. For getting show birds, use a sound, even-coloured male, and mate him to close blood relations, and, if of good pedigree, you will not be disappointed.

"I hatch principally with hens, and, when convenient, put two or three hens down at same time, and, when hatched, give all the chicks to one, coop her snug and dry, and the other hens can go back to laying. I have an incubator and brooders—Cypher's, about the best—but you cannot beat the hen. I feed on dry food, plenty clean, cool water, shade and shelter of the trees, and kill all weaklings as early as possible—that is, directly found. As they get to four to six weeks, I feed soft food of a morning, boiled grain at midday, meat twice a week, and dry oats, maize, barley, or wheat at night."

With all that has been now said about this breed of fowls, it will be apparent that for the exhibitor whose desire is prizes and their contingencies, or the farmer whose object is the greatest quantity of eggs and meat, there is no breed of domestic poultry which can be recommended to have greater all-round properties as that now so universally known as the popular Orpington.

(*To be continued.*)

Bacon.

A Report from the Agent-General.

The Honorable the Premier and Colonial Treasurer has received a report from the Agent-General, in London, stating that six sides of New South Wales bacon, shipped by various factories through Messrs. Dalgety & Co., were borrowed for exhibition, with our exhibits at the Grocers' Exhibition, at the Agricultural Hall, Islington. As far as the quality of the meat was concerned, this bacon was unanimously commented on in favourable terms. The only criticisms met with were in regard to the butchering and dressing of the sides in one direction, and in connection with the size, shape, and fatness of the sides in another.

With reference to the butchering, the chief faults found were that the aitchbone and bladebone had not been removed, and that the knuckle had not been sawn off sufficiently close to the gammon; also, that in taking out the backbone, too much meat had been removed with the bone, thus spoiling the concave appearance of the back of the side, so far as meat is concerned. The back being one of the most valuable parts in this country, and the general taste being in the direction of a fair amount of lean, it is advisable that this point should be studied.

With respect to the sawing of the knuckle, it is sufficient to say that the knuckle should be sawn off as close to the gammon as is compatible with not causing the meat to "string away" from the bone.

In connection with the size and fatness of the sides, it is necessary to point out that in this country there are two markets—the London and Provincial—and that they differ absolutely in their requirements. London wants a small, lean side of bacon, whereas the provinces generally, and particularly the agricultural districts, require a large, fat side—the fatter the better. Of the sides exhibited at the Show above-mentioned, some fulfilled the London requirements, and some the provincial, proving that New South Wales can supply both. There is one point in connection with this matter, which is outside the questions of dressing and size, and that is shape. The ideal shape of a side of bacon is a small fore-end, and good thick concave middle cut, and a heavy, well-rounded gammon.

In this particular our bacon is somewhat deficient at present, and the fact was noticed by every practical man who examined it at the Show. It was described by a big man as too "piggy." This is, of course, a matter which can be altered only by close attention to the question of breeding for bacon, *per se*; but that it is necessary in the best interests of the industry, there can be no possible doubt.

In view of the existence of several excellent studs of pure breeds of imported pigs at the Hawkesbury College, Experimental Farms, and

Rookwood, Liverpool, and Newington Asylums, it might prove of educational advantage if certain types of pigs could be utilised for bacon, to be submitted to the trade and to the public in Great Britain for specific criticism and report. The bacon could be shipped in cool storage unsmoked, and the smoking could be carried out in England.

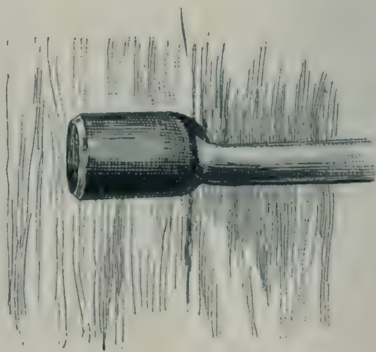
The prospects of export trade are encouraging enough to justify special efforts to ascertain the precise requirements of London and country buyers of bacon. In order that exporters may have perfectly authentic guidance, it is suggested that in each case one side of the bacon from a carcase be forwarded to London, and the other side be kept in Sydney for reference. When the English reports are received, a copy of them could be attached to the "reference" sides.

Wire Fencing.

Mr. Elliott J. Rien, Myee, writes, enclosing a sketch, which is reproduced, of a simple tool for plugging wire fences during the process of straining. In the October *Gazette*, page 960, in an article "Hints on Fencing," the plug

Iron Plug—showing hook to facilitate removal.

shown in the illustration is of a bad shape, being too short and dumpy, which would be hard to get out. With a tool such as Mr. Rien uses there is no difficulty in removing the plug. It is made of round bar-iron, 15 to 18 inches long, and about ¾ inch thick, tapering to a point, commencing about 8 inches from one end; a hook is turned up 1½ to 2 inches at the other. Now, when the wire is strained sufficiently tight, drive this peg into the hole, keeping the wire at the side of the hole, and it will hold securely while fastening; if the wire is allowed to press against the top or bottom of the hole it is very apt to bed into the grain of the post and slip. When the wire is fastened the peg can be knocked out with an axe or hammer by striking on the hook. Any blacksmith would make this for a few pence, and the saving in time is very great.



Showing the plug holding wire against side of hole in straining post.

Reports from the Commercial Agents.

SOUTH AFRICA.

Canned and Bottled Fruits.

THE MINISTER FOR AGRICULTURE has received the following reports from Mr. Valder, the Commercial Agent at Cape Town, saying :—

The following are the returns of the imports into South Africa, through British ports, of canned and bottled fruits during the past four years :—

	1901.	1902.	1903.	1904.
Imported from—	lb.	lb.	lb.	lb.
United Kingdom	2,015,737	1,259,484	790,483	628,028
United States	2,257,996	2,221,230	858,313	682,578
Australia	923,492	746,604	253,363	488,303
Other countries	70,829	115,674	223,049	244,677
	5,268,054	4,342,992	2,125,208	2,043,586

It will be seen that there has been a great falling off in the importations of canned and bottled fruits, but the years 1901 and 1902 were abnormal, and I think that we may conclude that the imports of 1903 and 1904 represent the normal imports. The imports from Australia during 1904 nearly doubled those of 1903, and I believe that the trade would have been much greater had it not been that there was considerable difficulty in obtaining a regular supply. The same trouble is again occurring this year. The merchants state that the Australian brands of canned fruits are giving great satisfaction, the canning and get-up generally being first-class, and the fruit often being equal to or even superior to that of the finest Californian brands; but the trouble is that the Australian canners do not appear to be able to keep up the supply. One large Cape Town firm reported that they had received a sample consignment of canned fruits of a new brand, and that the fruit was so satisfactory that they at once cabled for a further supply, but that they were astonished to receive the reply, "Regret cannot supply any more canned fruits this season." The general opinion is that both quality and price are satisfactory, and that with a more regular supply this trade could be greatly extended.

The latest quotations for Californian canned fruits, f.o.b. New York, are as follows :—

	Currency.	Sterling.
Extra Standard California Crawford Peaches, 2½s., 2 doz. to case, per doz. ...	1·75	7/1½
,, ,, Lemon Cling Peaches, &c., 2½s., 2 doz. tins to case, per doz. ...	1·85	7/6½
,, ,, Pears, 2½s., 2 doz. tins to case, per doz. ...	1·90	7/9
,, ,, Apricots, 2½s., 2 doz. tins to case, per doz.	1·50	6/1½
,, ,, Plums, &c., 2½s., 2 doz. tins to case, per doz. ...	1·45	5/11
Standard New York State Apples, 3s., 2 doz. tins to case, per doz. ...	·85	3/5½
,, Maryland Tomatoes, 3s., 2 doz. tins to case, per doz.... ...	·70	3/-
,, quality Sweet Corn, 2s., 2 doz. tins to case, per doz	·90	3/8
,, ,, Succotash, 2s., 2 doz. tins to case, per doz.	1·00	4/1
,, ,, String Beans, 2s., 2 doz. tins to case, per doz. ...	·90	3/8
,, ,, Peas, 2s., 2 doz. tins to case, per doz.	1 00	4/1

Standard fruits 10c. lower than the extra standards.

Of the 488,303 lb. of canned fruits imported in 1904 from Australia, New South Wales only contributed 26,237 lb., whereas Victoria supplied 245,781 lb., and Tasmania 215,536 lb.

The quantities given in the annual returns represent the nett weights of the contents of the cans, *i.e.*, the fruit and the syrup, upon which the duty of 2d. per lb. is payable.

Dried Fruits.

The Minister for Agriculture has also received a report from Mr. Valder, saying that the quantity of dried fruits imported into South Africa through British ports during the past four years was as follows :—

Imported from—	1901.	1902.	1903.	1904.
	lb.	lb.	lb.	lb.
United Kingdom	4,360,993	4,945,644	3,812,211	3,038,402
United States	1,196,444	1,133,154	1,129,669	765,981
Australia	182,886	190,197	55,261	84,811
Other countries	310,631	523,602	797,814	1,278,549
Total	6,050,954	6,792,597	5,794,955	5,167,743

This means an annual expenditure of from £60,000 to £70,000 upon dried fruits. It will be noticed that there has been a decrease in the total quantity imported. This is due, I consider, to the general depression in trade, the increased local production, and to the fact that the demand in the years 1901 and 1902 was an abnormal one, caused by the presence here of such a large body of troops during the war. It will also be noticed that the imports from Great Britain, United States, and Australia have all decreased, whereas those from foreign countries have rapidly increased. As the dried fruits imported from Great Britain are grown in other countries, such as Spain, Greece, &c., and reshipped to South Africa, it was to be expected that, with improved conditions of transit between those countries and the Cape, the imports of dried fruits from Great Britain would gradually fall off. With America the decrease has not been much above the average. But with

Australia the imports are down to less than half what they were in 1901 and 1902. This was due to the low prices ruling here, and to the fact that Australian merchants could not quote for large quantities. Prices for most kinds of dried fruits have hardened of late.

The following are the latest quotations, f.o.b. New York :—

	Currency.	Sterling.
New York State Evaporated Apple Rings, cases, 50lb., per lb.	1·08½	-/3⅝
Fancy Evaporated California Apricots, 25lb. cases, or 40lb. wooden pails, per lb.	·12¼	-/6
,, ,, Peaches, ,, ,,	·11½	-/5½
,, ,, Nectarines, ,, ,,	·09½	-/4⅜
,, ,, Pears, ,, ,,	·13	-/6½
,, ,, Prunes, 40/50s., 25lb. tins, or 40lb. tin pails, per lb.	·07¼	-/3⅜
,, ,, ,, 50/60s. ,, ,,	·06½	-/3¼
,, ,, ,, 60/70s. ,, ,,	·06	- 3

(In 40lb. tin pails at extra cost of not more than 1c. per lb.)

The prices quoted for apricots is high, and should admit of Australian fruit coming in; yet, only this week, a large Cape Town merchant told me he was not able to get Australian apricots at this price. As a rule, especially for the up-country trade, the merchants prefer to have the apricots, peaches, prunes, pears, &c., packed in tin pails, for which they are quite willing to pay the extra ½d. per lb. charged by the American packers. Of course, a large portion of the fruit referred to in the annual returns consists of currants, raisins, figs, dates, &c., nearly all of which come from Southern Europe; but there is also a considerable importation of apricots, peaches, prunes, pears, &c., a large portion of which comes from California, and it is in the latter fruits that Australia should be able to increase her share of the trade. With regard to the locally-produced dried fruits, their production has not increased nearly as rapidly as was expected. It has been proved that many parts of the Cape are well suited for the growth of varieties of fruits suitable for drying, and that the climate is so favourable that, in most seasons, these fruits can be dried in the sun with little or no artificial aid. Recognising this, the fruit-growers here have, for some years past, produced large quantities of raisins, sultanas, apricots, prunes, &c. The grocers maintain that the local sultanas are equal to the best imported, and that the cooking raisins are of such good quality that there is no need to import. Some good samples of apricots and prunes are also produced, and sell in Cape Town at 6d. per lb. for the 25lb. box. A very large portion, however, of the local dried fruits are of inferior quality, the fruit being small and badly got up, some of the samples of these exhibited in the windows of the small grocers' shops in Cape Town being about as unattractive in appearance as one could well imagine.

This production of such a large percentage of inferior dried fruits has resulted in a large portion of the people preferring the imported fruit, for which they have to pay at least 50 per cent. more, and I think that we may safely assume that there will be a demand for good quality dried fruits here for many years to come.

Broom Millet.

Mr. Valder will be glad to have particulars of price and size of bales of New South Wales broom millet, d.d., c.i.f., South Africa, and where a c.i.f. price cannot be given, then a quotation f.o.b. Sydney. Parties contemplating attempting to export millet broom will require to pay particular attention to quality and even character of the millet throughout each bale. Millet bales not of fair quality throughout and unable to pass inspection would probably not meet the requirements of purchasers.

Japan.

Fruit, Jam, Wine, &c.

The Minister for Mines and Agriculture has received a report from Mr. J. B. Suttor, at Shanghai, wherein he makes mention of trade in fruit, &c. He says there are not any statistics available as to the annual importations; but it would appear that a good business is being done in fruits from California, principally apples. Quite recently a shipment of Australian fruits reached the Shanghai market, where there is a fairly good demand for apples and oranges, &c. Mr. Suttor was informed, however, that the trial shipment arrived in very bad condition, and solely on account of being sent as deck cargo. It is simply out of the question to attempt to send fruits to Shanghai without doing so in proper cooling-chambers. On arrival, over 80 per cent. of the fruit was found to be absolutely rotten. With proper storage the fruits should arrive in excellent condition, and a good business is capable of being worked up.

With reference to jams and preserves, Mr. Suttor has received a few inquiries from leading merchants, and he has placed them in touch with Sydney people, and is hopeful that business will eventuate. One large dealer asked Mr. Suttor to have a look at some Australian jam he had imported some time back. The quality was excellent, but the tins bad, and the general get-up defective. When the tins arrived they appeared to be fairly good, but later on they exhibited nasty marks, and the paper wrappers faded, and otherwise gave the tins a very dirty appearance, thus preventing sales. As previously pointed out, shippers and manufacturers must adopt methods equal to the English jam makers before there can be success with the article on the China market.

As to wines, Mr. Suttor has been given to understand that some samples sent have proved satisfactory, and that small contracts are likely to be arranged for certain Australian wines. Australian brandy is coming into favour, and a small business is being done by Eastern agents, which may considerably increase during next year.

Licit and Improved Treatment of Grape Juice in Wine-making.

M. BLUNNO.

AGAINST the natural advantages of a reliable climate for the thorough ripening of grapes, there is the baleful influence of usually hot weather during the time when grapes are brought to the cellar to be made into wine.

February and March are hot months all through the vine-growing districts of the State, and a thermometer placed with its bulb in a heap of grapes will constantly show a temperature ranging from 70° to 80° F., and often higher still.

On account of the almost semi-tropical summer, grapes are apt to become overripe within the turn of a week. A percentage of grape-sugar varying from 21 to 25 is the usual standard of the musts of the districts with a larger rainfall, from 25 to 30 and over that of those where the rainfall is less. The generality of musts in Australia, few cases excepted, are deficient in fixed acids, which are as important as the sugar itself for a good fermentation and for the formation of those characters which concur to form the *tout ensemble* of a wine of a fine quality, that quality which is due to the contribution of so many factors, some of which are well-known, while others cannot as yet be collected into the chemical crucible, but are only seen with the mind's eye.

Wine-making conducted in the cool districts of Central Europe is a much easier work than in fairly hot countries, and, indeed, since viticulture began to be pursued in them, it was found by experience that the time-honoured practice of the old vine-growing districts were at fault. Hence scientific researches of the cause of so many troubles, which jeopardised the future of the industry in the newly-settled communities. The consequence was a general and startling progress in the application of science—a progress which, during the last twenty years, has been in uninterrupted ascendancy, steadily following in the wake of by micro-biology and micro-chemistry.

Special treatments of musts and wines have been tried and sanctioned by gratifying results—treatments, I say, which would have been condemned a few years ago without discussion, and would have been considered as manipulations, giving this word the meaning of illicit tampering with the vintage.

The destruction of vineyards caused by Phylloxera, which in the older countries caused many lands, not altogether fit for grape-growing, to be planted with vines with only one object in view, viz., large yields to make up the fall-off in the output, the numerous new pests which visited and became endemic, spoiling the crop year in year out, required more scientific handling of the raw material to counteract the influence of so many causes of the deterioration of the product.

A score of different new methods of wine-making have been, during the last ten years, advertised by experts of more or less repute. I daresay each of these new systems may have some good points and be convenient under some special conditions. A number of patent chemicals have sprung up and are widely advertised, and the wine-maker is, often through ignorance, induced to use them and it may be in some cases he brushes with the Police Court.

I shall write in this article on the rational treatment of musts, in order to bring its chemical composition to a proper balance between its ingredients. The adverse season, the visitation of parasites, or the unsuitability of the soil may be the cause of excesses or deficiencies of some of the said natural ingredients, and the skilled wine-maker ought to remedy that which Nature has failed to do.

Tannic Acid.

Tannic acid is principally contained in the grape seeds, is also plentiful in the skin of red grapes, in which it is combined with the colouring matter. Skins of white grapes contain much less of this substance. Tannic acid is very largely distributed in the vegetable kingdom and its real chemical nature varies according to the source. The tannic acid of grapes is of a kind not found in any other fruit or plant, and is called œno-tannin. It is a sound keeping ingredient of wine and a factor of brilliancy on account of its faculty of combining with albuminoid substances, which are apt to cloud it more or less persistently. Brilliancy is obtained with greater difficulty in white than in red wines, exactly because white wines contain hardly any traces of tannin, while even in light clarets there is from ·8 to 1 part of this substance in every 1,000 parts of wine. The cloudiness in a sound wine is due to organic nitrogenous substances, which are in a state of semi-solution. Sometimes in some wines it disappears and the wine becomes bright, because the slow oxidisation which they undergo renders them totally insoluble, hence they precipitate to the bottom of the cask. Heat, as applied in pasteurizers, has the effect of coagulating the nitrogenous substances and determines their sinking. Intense cold, though to a lesser extent than heat, may have the same effect. Both these agents are greatly helped by the alcoholic strength of the wine, a higher quantity of alcohol enhances the desired effect. It is evident then that the strong aeration of white musts, or white wine, by stirring with some suitable contrivances, will secure their more rapid clearing. The first effect, in case of white musts, will be a thick turbid liquid, like a tank of water in which the clayey silt has been stirred, and in white wine the cloudiness becomes opalescent, because the substances which were in semi-solution begin to take consistence. Often two white wines, with almost similar chemical compositions and having received equal treatment, show a marked difference as to their respective limpidity. The reason, then, may be one of a physiologic character, and may be sought in the race of yeast which predominated in the fermentation.

The diastase secreted by the alcoholic yeast differ as differ the numerous kinds of leaven. Perhaps one diastase secreted by one sort of yeast may be more effective in coagulating the albuminoid substances than the diastase secreted by another. This assumption seems to be supported by experiments made with various kinds of ferments operating on different lots of the same juice. Some lots clarified very quickly, others took longer, others were persistently cloudy.

The tannin of grapes, like all other tannins, is apt to combine with organic nitrogenous substances and form tannates, which have solid consistence and therefore sink readily. This is the chemical principle upon which is based the fining of the wine. Red wines contain enough tannin for the purpose of a self-clarification; this, however, is often anticipated by the addition of gelatine or white of eggs in order to cause the formation of a kind of film which, by gradually sinking under its own weight, drags any solid particle previously suspended in the bulk. White wines, on the contrary, hardly contain one-tenth of the quantity of tannin which is found in red wines. The approximate proportion in which tannin and organic nitrogenous substances combine are 1 to 1. I said purposely approximate, for the reason that the influence of the chemical composition of the wine is paramount, because the quantity of alcohol, acids, extract, the bulk and temperature can all alter the 1 to 1 proportion, which, however may be taken as a mean. The quantity of albuminoids contained in white wines is quite in excess to that of tannin, and if such wines are often tolerably clear, it is not the action exercised by the traces of tannic acid, but that exercised by the alcohol which has power to cause their partial coagulation.

The presence of relatively large quantities of albuminoids will never cause the total precipitation of all traces of tannic acid. Excessive and repeated proportion of gelatinous or albuminous fining may be added to any wine, red or white, and yet all the tannin would never be extracted, the wine always retaining a proportion of it. Those of my readers who possess a knowledge of chemistry will understand that this is a fact regulated by the law of mass-action. When white wines remain cloudy, I always advise the addition of tannic acid at the rate of 2 oz. per 100 gallons, and double that quantity for the tannisation of the wine prior to the addition of the fining, be it isinglass, blood, or milk.

Tannisation of Musts.

To avoid the trouble of wines which will not clear quickly and thoroughly, it is advisable to add tannin to the musts before or during fermentation. This practice is not by any means new and has been in vogue in many districts in Europe for years, where wine-makers in a small way find that it improves the wine by letting the must of red or white grapes ferment with substances which are rich in tannin, such as chips of bark of oak tree, peel of pomegranate, &c. This is resorted to especially with grapes which are naturally poor in œnotannin, or in wet seasons, when musts are watery and moulds affecting the berries destroy the tannin contained in the skin. The method referred to is rather crude, and has the inconvenience of not permitting the regulation of the proportion of tannic acid nicely, besides the risk of tainting the wine with strange tastes. No modern authority would recommend such an empirical process, and I mentioned it only in support of the modern idea of adding to certain musts a well-considered proportion of the purest tannic acid specially prepared for wine-making, which is free from the pharmaceutical smell of the commercial tannin. After the appalling havoc caused by phylloxera in France, some of the richest flats formerly devoted to horticulture have been put under vines. The Aramon, a red and most prolific grape, has been preferred by the majority, particularly in the south. This variety is rich enough in colour, but its must is extraordinarily rich in organic nitrogenous substances, all the more so when this kind of vine is grown in very fertile plains or valleys. I pointed out in the foregoing that the colouring matter of grapes is of tannic nature and, properly speaking, the tannic substances of same include also the colouring matters. It follows, then, that the excess of albuminoid substances will not only act on the œno-tannin but also on the colouring matter, as both gradually dissolve in the fermenting juice, thus a great proportion of colour, instead of remaining in solution, sinks with the lees. The addition of tannic acid to the must has, among the other advantages in this case, that of ridding the must of the surplus of such substances, which otherwise would eliminate portion of the colouring matter.

In wet seasons or when grapes have been spoiled by visitations of parasites, tannic acid mixed in the must is considered a great help, and satisfactory action is everywhere recorded. The yeast-cells like all micro-organisms are apt to be stained, and they are readily stained by the colouring matter of the wine. The countless millions of yeast-cells contained in a fermenting red grape-juice are responsible for the elimination of a good deal of the colouring matter. Their cells can also fix the tannin, natural or added, and the effect on the fermenting activity and prolificity is the same as that caused on live micro-organism by the action of stains. The cells of musts in which a certain proportion of tannic acid has been dissolved will remain smaller and will multiply less rapidly, hence the fermentation will proceed slowly, the sugar will disappear gradually, fermentation will take longer, and the quantity of heat corresponding to that of sugar will spread over a longer period of days and never rise suddenly and over-reach the critical point when the yeast, besides producing alcohol, yields also acetic and other acids which spoil the wine, while a number of other micro-organisms become also balefully active. Tannin therefore attenuates the fermenting power of yeast without changing its nature, a fact which tallies with that of a similar order of the stained bacilli of a virus which is purposely so treated in order to attenuate its power and be used for the immunisation of animals against certain infectious diseases. In the making of red wines, it is not considered necessary in the generality of cases to add tannic acid either before or after fermentation, because there is more than enough of this ingredient in the skins, seeds, and stalks, so much so that in many instances it is advisable to stem the bunches, that is, to separate the berries from the stalks. It is different however in the making of white wine. White musts contain only traces of the natural tannin, because from the fermentation are excluded all the solid parts of the grape bunches where it is stored. The preliminary addition of tannic acid to musts before the beginning of fermentation or even in the act of fermenting or soon afterwards is a very commendable practice, because wines will clear quickly. The organic nitrogenous substances by quickly sinking and being soon removed through the successive rackings will be lost to the pathogenic micro-organism which feed on them and cause the various alterations of wine, the most common in white wine being the tartaric fermentation and ropiness. Tannic acid is *per se* a natural preservative. A certain proportion of it also gives wines "nerve," as European wine-tasters express themselves colloquially.

Tannin is, besides, the sovereign remedy against the *casse* of red or white wines, whereby the former lose their ruby tint, acquiring a doubtful rusty hue and the latter a dark dirty yellow, in both cases the wines becoming very turbid.

Quantity and mode of using Tannic Acid.

Tannic acid is soluble in the must and in the wine, but it would almost totally sink before it had time to dissolve all through the bulk if it were added in its powdery state. It is therefore advisable to dissolve it in brandy, 1 gallon of which will keep in solution as much as 2 lb. of tannic acid.

A suitable quantity of tannic acid to be added to the must varies from 2 to 3 oz. for every 100 gallons of juice. It is necessary therefore to prepare a solution of known strength and mix it in proportion to the bulk of must—for instance, suppose 1 lb. of tannic acid is dissolved in 1 gallon of brandy, every pint of this solution will contain 2 oz. of tannic acid. From 1 to 1½ pint of the solution would suffice for 100 gallons of must—that is, if you put 1 pint by so doing you add 2 oz., and if you put 1½ pints you add 3 oz. of tannic acid to 100 gallons of grape juice.

The quantity of tannic solution decided upon is first mixed with about 10 gallons of must, then these 10 gallons are added to the other 90 gallons and thoroughly worked together.

The opinion is divided as to when the solution should be added, some say before and others say during fermentation and others again after the must has become wine. The majority however agree that it is best to mix it before fermentation if grapes are not clean and sound or if the grapes are hot, which would naturally be the cause of a rapid and great increase in the temperature of fermentation with certain deterioration of the wine. The tannic solution may be mixed to the bulk after fermentation if grapes were sound, clean and cool, but were grown on rich flats.

Increasing Fixed Acidity of Musts.

Fixed acids are the free organic acids and acid salts of the must, their totality constitute what is called fixed acidity. These acids are the malic and tartaric acids and the acid tartrate of potassium.

Malic acid is predominating in grapes and is the same as that found in apples. Acid tartrate of potassium is the acid salt of the tartaric acid, is also called potassium bitartrate and colloquially called cream of tartar when pure and wine stone or argol in its raw state. Of the free tartaric acid small quantities are found in must or wine, but often in extra ripe grapes none at all.

Other vegetable acids are found in grape-juice, but only in infinitesimal quantities and always in unripe grapes. Grapes, when green, contain succinic acid, which however is normally found in wines in quantities that can be chemically estimated; but in this case it is a normal product of the fermentation of the sugar, like alcohol, carbonic acid, glycerine. Glycolic acid was found by Erlenmeyer, and oxalic acid combined with lime is also found in the well-known crystal formation of calcium oxalate, contained in the cells of many plant tissues, *raphides*, or needle-shaped crystals. Oxalic acid is characteristic of the sorrel-plant, *Rumex oxalis*. Such crystals found in the tissues remain in the husks and therefore must and wine are free from them.

When speaking of the fixed acids of the must it is only intended to refer to malic acid, to the potassium bitartrate and to free tartaric acid. In a thousand parts of must of ripe grapes the quantity of malic acid is about 3·5, that of the potassium bitartrate from 4 to 8, according to the temperature of the liquid and that of free tartaric acid from ·2 to ·6.

The acid power of the above-named substances varies, that is to say, that to the unit quantity of each of them corresponds a coefficient of acidity which varies from acid to acid. Malic acid is more acid than the tartaric and this is more acid than the bitartrate of potassium. This is the relation in which they stand as to their acid power taking tartaric acid as unit:—

Tartaric acid	1·
Malic acid	·893
Cream of tartar	·399

For all practical purpose it is quite sufficient to know the total acidity of a must. Therefore no separate chemical estimation is made of these respective substances. The total acidity is determined with a standard alkaline solution, and in the calculation the coefficient of the tartaric acid is preferred. To have a practical idea of the acidity of a must a comparative standard is taken. Tartaric acid is generally preferred as term of comparison, so the total acidity of must is calculated as if it were all due to the said acid alone. This simplifies matters, because instead of expressing the respective acidity due to the presence of the various acids isolately estimated, they are estimated collectively and referred to the unit acidity of one of them taken as standard. In some countries, in France, for instance, instead of calculating the total acidity of a must as tartaric acid they calculate it as sulphuric acid. It makes no difference what acid is preferred for comparison as long as it is explained; therefore when I say that a must contains 6·5 per 1,000 of total acidity, I must say whether the acidity was calculated as tartaric, sulphuric or any other acid. In fact, a total acidity that would be expressed by 6·5 if calculated as tartaric acid, would be expressed by 4·25 if calculated as sulphuric acid; or, in other words, 4·25 parts of sulphuric acid are as acid as 6·5 parts of tartaric acid. If sample A of Hermitage contains 6·5 of total acidity calculated as tartaric acid, and sample B of Malbeck contains 4·25 per 1,000 of total acidity calculated as sulphuric acid, the acidity of those two samples is equal.

The importance of a suitable proportion of fixed acidity in must has been settled beyond any possible discussion by a long practice which followed the experiments scientifically conducted at Government laboratories and experimental cellars in different vine-growing districts in the south of Europe.

The total acidity of a must should not be below 7 per 1,000 calculated as tartaric acid. From numerous tests which I had the opportunity to make for the last nine vintages in this State, I am enabled to say that with very few exceptions musts in New South Wales all fall short of that proportion, and to increase the acidity of grape-juice is a practice that I should like to see becoming pretty general in this country.

A convenient acidity ensures by far a better fermentation, and musts will ferment out until they are dry, which is a great advantage in making clarets, Hocks and Chablis types. Many alterations to which wines are so easily subject and are caused by bacterial life are thus avoided, and the colour, brightness, and palatable characters of the wines are very much improved. Wines deficient in fixed acids never develop a really fine bouquet. The acids which are employed for raising the total acidity of a must are either the tartaric or the citric acid.

Tartaric acid is a natural constituent of the must, therefore its increase within the proper limit does not constitute an adulteration. Citric acid can hardly be considered a natural ingredient of the grape-juice, although traces of it have been found by some analyst and in some grapes. It is also contained in strawberries, gooseberries, raspberries, mulberries, cherries, medlars, &c., and is the principal acid of citrus fruit. The legislation against the adulteration of wines of some European countries does not mention citric acid as a licit substance in the treatment of musts or wines and on that account it was also excluded from the Act in force in New South Wales, although the writer realises the great advantages that citric has over tartaric acid.

I shall not go into details about the comparative advantages of citric acid. In the Act there is no provision absolute or contingent for its use, and the matter may end there. Rather let us see how the kindred acid, the tartaric, must be used.

Experiments made several years ago by Signor Chiaromonte at Barletta, and confirmed later by Signor Pagnotta and other Italian œnologists, go to show that when tartaric acid is dissolved in the must it is found that after fermentation a portion of the acid so added does not remain in solution, but combines with potash and forms cream of tartar, which sinks with the lees and is lost as far as its effect on the wine. If tartaric acid is added to the must and this is fermented without skin, as is the case for white wines, only 47 per cent. of the quantity dissolved is afterwards found in the wine, and if it is dissolved in the juice and this is fermented with the skins, then only 25 per cent. remains in the wine ; that is to say that in the first case only half is utilised and in the second but one-fourth.

Supposing that we test the fixed acidity of a must and find it to be 6 per 1,000, calculated as tartaric acid. Such proportion being low it should be raised to 7 per 1,000, thus, in view of the experiments, the deficiency is made up by adding two parts of tartaric acid in every 1,000 of must if it is intended to ferment it without the skins and four parts if it will ferment with the skins, viz., 2 lb. of acid for every 100 gallons of must without skins and 4 lb. of same for every 100 gallons to which the skins will be added. The relative proportion is the same for quantities over 100 gallons.

Tartaric acid can be bought in Sydney. It should be pure, free of lead ; it costs about 1s. a lb. In making the above calculations I purposely chose a must with 6 per 1,000 of fixed acidity, because within a fraction more or less it is the proportion generally found in the grape-juice of this State, therefore the quantities calculated to meet this case can be adopted in practice by the great majority. The acid in question is readily soluble in must ; it can be dissolved, first in three or four buckets of must (wooden buckets to be preferred), and then this is well mixed with the bulk.

It might be said that by making an early vintage and picking grapes before they are too ripe the necessity of adding tartaric acid may be avoided. So it may, but where the vineyard is a large one and the vintage takes two or three weeks, it will be found that the grapes that are picked last will yield a juice very deficient in acids.

How to Control the Temperature during Fermentation—a substitute to Fumes of Sulphur.

One of the treatments to which grape-must is submitted and has been adopted for the last two or three vintages by a great number of wine-makers in the more advanced districts of Europe, is the addition of a certain proportion of potassium metabisulphite. In the temperate zones where the visitation of parasites and often long periods of wet weather spoil the grape crop and in the more congenial climate of the south, in Algeria and Tunisie where, unless musts by some means or other are cooled down the wine is sure to be spoiled, the practice of mixing the above-mentioned substance with the must before fermentation is finding increasing favour.

Italian and French literature on the subject is a chorus of eulogies, and the remarkably good results obtained by the judicious application of the system are superior to those obtained by the cooling of the fermenting juice with the various machines and devices now more or less in vogue in those vine-growing districts where vintage takes place during hot weather. In previous articles in the *Gazette* I had an opportunity to deal at length on the relation between temperature and fermentation and the deterioration which the wine is subject to if during fermentation the heat developed in the vat rises beyond the limit *optimum* for the normal physiologic activity of the alcoholic yeast. Premature conclusions with reference to the respective action of the congery of micro-organisms budding forth in the juice of grapes have assigned a distinct and independent action to a number of them, which bacteriologists have rather too hurriedly classified.

Duclaux, late Director of the Pasteur Institute, points out that the various kinds of yeast have been by previous micro-biologists divided into so many races; boundaries have been marked between them in many instances misleading. He recognises the impossibility at the present time of a systematic division of yeast races with well-defined characteristics. The further study of microbial life in the grape-juice and wine has shown that the characters by which the various kinds of yeast and microbes had been differentiated become more confused and complicated the closer their study. It was believed, for instance, that the agents of alcoholic, lactic, butyric, mannitic, and other fermentations had nothing in common and that they were the respective and only agents to which was due the formation of alcohol, lactic acid, butyric acid, mannite, &c. At present, on the contrary, a large number of microbes are known that are agents for the production of alcohol, and of many other substances, among which may be mentioned acetic, lactic, butyric, carbonic acid, either singly or differently associated. When, therefore, the alcoholic, acetic, lactic, butyric, &c., ferments are mentioned, they must be considered as the principal, but not the sole agents of alcoholic, acetic, lactic, butyric, &c., fermentation.

The principle is still maintained that ferment secretes a substance, the diastase, which acts chemically on the sugar. Further still, Duclaux is of opinion that the alcoholic yeast is apt in special conditions of environment to produce acetic and other acids and aldehydes, therefore it may secrete many special diastases other than the alcoholic one just as there are secondary substances produced during fermentation. In other words, the alcoholic yeast for instance may secrete, besides the alcoholic diastase a different one responsible for the production of acetic acid, another for that of butyric acid, one again for that of lactic acid, &c. In consequence of this the idea of the fermenting power of a yeast which was represented by the quantity of alcohol produced by a given weight of yeast-cell in a unit of time, must be corrected. Not the alcohol alone should be taken into account, but with it the total also of other substances formed in the fermented liquid which derived from the same yeast.

All efforts in wine-making should be directed to creating an environment to the yeast-cells in which they will act exclusively as alcoholic ferment. A must not overcharged with albuminoid substances, having a fair proportion of fixed acidity and sugar, cannot fail to give a fair wine even if the grapes are not of the finest varieties or even if they were grown in soils not quite suitable. This result will be attained, provided that fermentation takes place at relatively low temperature which should not rise, when at its highest, over 92° Fah.

In previous articles I explained and illustrated several ways for keeping the temperature in the fermenting vat within the proper limits. I shall resume them here and then I shall write more fully about the use of potassium metabisulphite as a more expeditive and more effective means to the same end.

1. Gather the grapes early in the morning and crush them soon afterwards; or gather them in the evening, spread them on a suitable cement floor in a well-ventilated place and crush them early the following morning. I know of a vigneron in the south of Italy who makes it a practice to take advantage of moonlight nights for grape picking.
2. If grapes are gathered during the hottest hours, they may be spread on a proper floor and sprinkled with water. If the room is well-ventilated the quick evaporation of the water will cool the grapes effectively.
3. Keep the windows of the fermenting-house closed in daytime and open them at night.
4. Never use false heads in the fermenting vats with the purpose of keeping the husks submerged.
5. Prefer always small-sized vats. Cement vats with thin walls are much more suitable than wooden vats.
6. If loads of hot grapes come to the crusher and cannot be by any other means cooled down, they may be crushed and the juice distributed in several vats so as to fill only a third of their capacity. When the morning loads come with the cooler fruit the juice is divided among these vats.
7. If the temperature of a vat rapidly increases and there is the certainty in view that the heat will rise beyond 92° Fah., the bulk of juice and skins may be proportionately split and placed in three or four vats and cool must mixed with each lot. No risk whatsoever is run by mixing musts at different fermenting stage. The result is beneficial in every way.
8. Adapt within the vat coils of piping through which a supply of cool water is kept running, or use one of the various coolers now on the market, like that suggested by Roos and named after him, or the other made by Guilleband, which is much the same.
9. Strong aeration of the must by a contrivance that will work like a churn, giving the propeller a speed of 500 or 600 revolutions per minute.
10. Wine-makers who are in a large way of business, or large co-operative wineries might find it convenient to employ refrigerating machines, of which there are various kinds, like that of Linden, in which the refrigeration is obtained through the evaporation of ammonia, that of Riedinger, and the other of Pictet in which carbonic acid and sulphurous acid are respectively used as cooling agents.

Everything considered, most of the above-mentioned systems are either beyond the reach of the average wine-maker, or very inconvenient, entailing a loss of time, the employment of extra hands and the necessity of the erection of special cellars and shades, or the setting aside of a number of wooden vats, still good and serviceable.

Potassium metabisulphite.

It is generally known that the fumes of sulphur act as a check of all bacterial life, and it is for this faculty that such fumes are largely used in cellar work and in the treatment of wines. Fumes of sulphur are nothing else than sulphurous acid. Potassium metabisulphite is a compound of sulphurous acid with potassium. It is in very white crystals, soluble in water, must, or wine, specially if the solvent is warmed. Potassium metabisulphite is not a very stable salt; therefore a weak acid solution like that of must or wine will decompose it and the sulphurous acid contained in it is set free. When the metabisulphite is dissolved in the grape-juice the acids of the latter will act on it, split it up, and give off free sulphurous acid, which remains dissolved in the liquid and checks its fermentation.

Sulphite, pirosulphites, and metabisulphites may be considered as nothing else but fumes of sulphur in a condensed form. Their only fault is their name, too scientifically chemical, on reading which the layman's eyes see the ghost of adulteration.

Yeast germs are abundant in the grape-juice and if the temperature of the liquid is about 60° Fah., the germs quickly begin to bud and multiply. When the temperature increases within certain limits, also the prolificity of the yeast-cells increases and it may be safely said that it is at its highest between 78° and 85° Fah.

The greater the number of yeast-cells the shorter is the time required for the splitting up of the unit quantity of sugar. The disappearance of sugar in a fermenting must is a chemical phenomenon. The place of sugar is taken by alcohol, carbonic acid, glycerine and succinic acid, which are the normal products of alcoholic fermentation. All chemical phenomena produce heat. The more rapid is the splitting up of the sugar, the greater the quantity of heat accumulating. It is not that a rapid fermentation produces a larger quantity of heat than a slower one; it is only that the same number of calories, instead of being produced, say in six days, are produced in two. In the former case a great deal of it disperses and the temperature of the liquid does not rise much higher than the initial degree; in the second, the dispersion is much less, and there is in consequence accumulation and a sudden rise over and above the initial temperature. The yeast-cells then find a new environment, within which, besides yielding the normal ingredients, produce other substances tainting the wine. A portion of the sugar that should have yielded alcohol is utilised by the yeast to produce these other substances which make wine unpalatable. If the multiplication of the yeast-cells is checked by some means, the splitting up of the sugar is made more gradual, fermentation will take longer to accomplish, but the sudden rise of temperature will be avoided.

The idea of using sulphurous acid to check the yeast with the view of keeping the must within the limits of temperature most suitable for a pure alcoholic fermentation is not four or five years old, viz., does not date since it began to be more widely known. The idea originated from Signor Czeppel manager of the experimental wine cellar attached to the Viticultural College of Catania, Sicily. Czeppel in 1890 added calcium sulphite at the rate of 30 grains to every 100 gallons of must and followed the progress of fermentation of this and of an equal quantity of grape-juice of the same variety as term of comparison. After ten days the sugar in the first must had totally disappeared and the wine was quite dry, while the witness was still sweet. In the former the temperature reached 89°; in the latter it went up to 96° Fah. In 1891 he repeated the experiment with the same success, and concluded that with 90 grains of calcium sulphite in every 100 gallons of must a decrease of from 12° to 14° Fah. can be obtained. He also suggested that the dose of calcium sulphite should be added in four times, a quarter each time, at the interval of twelve hours. Here we have then the method in all its details as is advocated to-day, the only difference being that instead of calcium sulphite the metabisulphite of potassium is preferred.

During the same vintage of 1891 Signor Chiaromonte, of the Government Experimental Cellar of Barletta, in Italy, experimented the influence of calcium sulphite on fermentation, and concluded that to check fermentation, and consequently reduce the temperature effectively, a dose of 1½ oz. was required for every 100 gallons of must. He found also that very small quantities of sulphite of calcium were apt to stimulate rather than to check the yeast-cells. This is quite in accordance with the results obtained by several scientists relative to the stimulating effect of small doses of antiseptic substances on the yeast and most bacteria. Signor Chiaromonte in concluding the report of his experiments was not very enthusiastic over the system and the chief objection to it he saw in the neutralisation of the fixed acidity caused by the calcium contained in the calcium sulphite.

It seems to me that the quantity of fixed acidity that may be neutralised by the calcium contained in 1½ oz. of sulphite added in 100 gallons of must is very small, especially when it is considered that the addition of tartaric acid in musts deficient in fixed acidity is quite licit and beneficial, and any slight loss in the fixed acidity through the action of the calcium sulphite can be made good.

The question remained at that stage for the following seven or eight years, until it was taken up again four or five years ago and the potassium metabisulphite was and is still advocated instead of calcium sulphite.

The advantage of the former over the latter is that its action is quicker, and can set free a larger proportion of sulphurous acid. 1 oz. of metabisulphite of potassium yields a little over ½ oz. of sulphurous acid.

How to use Potassium Metabisulphite to control the Temperature of Fermentation.

A suitable proportion is 8 oz. of metabisulphite for every ton of must and skins. In the case of white musts which are fermented without it the same dose of 8 oz. will suffice for the quantity of juice yielded by 1½ tons of grapes.

Supposing I have a fermenting vat in which I can place the juice and skins of 2 tons of grapes, 16 oz. of metabisulphite will be required. The mixing of this dose should not be done in one act. The 16 oz. of crystals are divided into four lots each of 4 oz.

The first lot of 4 oz. is put in a wooden bucket and a pint of boiling water is poured on it while stirring energetically. As soon as it is dissolved the solution is mixed with the bulk of must and skins and is thoroughly worked in with a long stick, or better still the solution of metabisulphite is poured when half the bulk of juice and skins is in the vat and on the top of it the second half is then added. Hardly any delay beyond the usual will occur before fermentation will start. The husks will gradually gather to the surface to form the cap and everything will proceed in the ordinary way to which the wine-maker is accustomed. A thermometer as well as a saccharometer should be kept handy.

The temperature of the bulk having been taken and recorded at the moment when the first dose of metabisulphite was mixed, its rising should be watched. About three times a day the thermometer should be plunged, so as to place its bulb just underneath the cap. There the heat is always highest, because of the skins on which the greatest number of yeast-cells are to be found. A glass cylinder is also filled with the fermenting liquid and the quantity of sugar contained is recorded for every test. By comparing the temperature and the percentage of sugar with the temperature and percentage of sugar recorded the last time, we can form an idea of how fermentation proceeds. If the sugar disappears rapidly and the temperature rises quickly the second lot of 4 oz. of metabisulphite is dissolved in another pint of water and put in a tub. About one-fifth of the bulk of the fermenting must is withdrawn from the vat and is let fall in this tub, while with a pump it is sucked from the tub and spread over the cap. I mentioned that it is just below the cap that the temperature is always highest, therefore the portion of the must conveying the second dose of metabisulphite will act directly on the top layers of the bulk to check the too great activity of the yeast-cells. Four or five hours are allowed to elapse and the temperature is taken again, as said before, together with a sample of the must of which the quantity of sugar is noted. If the temperature is not lower it should be the same as that of the previous reading or thereabout. The percentage of sugar will naturally show a decrease, because fermentation is only checked, but not stopped. It might be however, that in spite of the second dose, the fermentation continues to be very tumultuous and the temperature goes on rising. If such be the case the third lot of 4 oz. is added at once in the same manner as already explained.

Fermentation will receive a check this time, but the wine-maker should keep taking the thermometer readings every couple of hours, and when the glass goes up quickly the last lot of 4 oz. of metabisulphite is added. It might occur also that the last 4 oz. will not be required.

This system makes fermentation much longer and the vignerons of this State accustomed to seeing a must fermenting out quite dry, often in forty-eight hours, might find that its application will mean a larger number of fermenting vessels. That is so, because by subduing the yeast's activity the time required for the splitting up of the unit of sugar will be longer. I must remind them that fermentations, which take only two or three days to accomplish, are those that as a rule give wine of inferior quality, if not altogether unsound.

A must in which metabisulphite has been mixed will take twice the time to ferment its sugar, therefore those who will adopt the system should make provision for a larger number of vats. At the same time, they may be sure that this method of vinification is quite worth the trouble. If the winegrower should be short of vats he may withdraw the juice before fermentation is quite finished and let the residual sugar ferment in the cask, but before separating the liquid from the skin he should take an average sample and see whether the juice has enough colour.

Once fermentation is completed, or nearly so, the presence of sulphurous acid in the wine is no longer required.

When racking the wine it is let fall in a tub; from this it is pumped into the cask, which requires no sulphurising, aeration being necessary in this case and in every racking that will be done during the year.

Monthly Weather Report.

HAWKESBURY AGRICULTURAL COLLEGE.

Summary for November, 1905.

Air Pressure (Barometer).			Shade Temperature.				Air Moisture Saturation.			Evaporation (from Water Surface).			
Lowest.	Highest.	Mean.	Lowest.	Highest.	Mean.	Mean for 13 years.	Lowest.	Highest.	Mean.	Most in a Day.	Total for Month.	Monthly Mean for 8 years.	% of the year's Evaporation.
29·66 9th.	30·42 15th.	30·008	34·8 1st.	104·9 27th.	69·44	63·18	40 Several days.	100 30th.	50	0·377 13th.	in. 6·741	in. 5·495	12¼

Rainfall...									Total for Month.	Mean rainfall for 13 years.
Dates...	9	17	18	19	20	28	29	30		
Points..	6	1	7	2	4	10	145	335*	510	210

Wind.........	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
	3	20	1	1	4	7	3	8

Thunderstorms on dates—9.

Greatest daily range of Temperature, 51·3 on 16th.
Extremes of Rainfall in November, 0·340 in 1897; 4·317 in 1893.
Days on which Shade Temperature rose above 90° Fahr.—91·2 on 3rd; 94·4 on 7th; 102 on 8th; 97·4 on 9th; 94·3 on 11th; 96·4 on 12th; 94·5 on 16th; 100·5 on 17th; 94 on 24th; 95·4 on 25th; 99·2 on 26th; 104·9 on 27th.
A frost occurred on Nov 1.
Remarks.—A hot, dry, windy month, beginning with a frost, the first ever recorded here as late as November; all through the month from the 6th the extreme dryness of the spring was intensified. On the 27th occurred the hottest November day recorded here; a southerly broke the heat up. and was succeeded by good rain, which just came in time to prevent the summer crops from being a complete failure.

*These falls are in the ordinary way entered on the day succeeding these dates, consequently this fall would be recorded on December 1, and come in the December results in calculating the monthly rainfall and its means. The dates given for rainfall in the above table being the days on which the rain fell.

CHAS. T. MUSSON,
Observer.

Orchard Notes.

W. J. ALLEN.

JANUARY.

OWING to the cool backward spring this year nearly all fruits are late in ripening, and in many instances early and late apricots, cherries, &c., ripened at about the same time. On a recent visit to Armidale, for the purpose of investigating the nature of a disease which is causing a little trouble in one or two of the cherry orchards situated on heavy soil, I had an opportunity of inspecting several good cherry orchards, among which were those of the Messrs. Geo. and Charles Jackes, who, notwithstanding the unfavourable season, had very fine crops of cherries, which were of excellent size and flavour. The peculiarity which struck me most was to see the Florence and St. Margaret cherries ripening with the Napoleon and other earlier varieties; the trees, too, were bending down with the weight of the fruit they were carrying. I hope to be able to show one of the Florence trees, which was taken with its crop of fruit on, in the next number of the *Agricultural Gazette.*

Plums and apples have set better in many parts of the New England district than in the Southern and Western parts of the State. In these latter parts of the State nectarines are almost a total failure in many places; the peach and plum crops are light, as also some varieties of apples. On the whole, the fruit crop promises to be below the average. The fruits which this year are carrying the best are apricots and grapes. From the information which I have been able to collect, I fancy the jam factories will have some trouble in securing sufficient fruit this year to keep them running full handed throughout the season. Fruit fit for canning and jam making should, therefore, find a ready sale at good prices.

It will soon be time to treat citrus trees infested with scales, and wherever Bordeaux mixture has not been used since last fruit season, fumigation will be found the most reliable means of ridding the trees of these pests; but where the trees have been sprayed with the Bordeaux it will not be safe to fumigate. It will, therefore, be best to give the trees several dressings during the next two months with the resin, soda, and fish oil solution in order to keep the scales in check.

With regard to Fruit Fly, if all fallen and infested fruits were picked up and boiled, we would in this way destroy so many of the larvæ that it would only be a matter of time before this much talked of and destructive pest would be almost wholly eradicated, and, in consequence, the loss of fruit reduced to a minimum.

Peaches fit for canning and drying will ripen this month. For the latter purpose, see that the fruit is thoroughly ripe before picking from the trees. Cut them evenly before placing on the trays, cut side up, then submit them to sulphur fumes for about two hours, after which they may be placed either in the sun or evaporator, as the case may be. As soon as they are sufficiently dry, remove from the trays and place in calico bags, to keep them away from the fruit moth.

In canning, the fruit should be selected and peeled, then packed tightly in the bottle or tin, and a syrup varying in strength from 30 to 40 per cent. sugar should be poured over the fruit, filling to within a quarter of an inch of the top. If tins are used, they should be sealed down, leaving a pinhole in the tops. Exhaust by plunging into boiling water for five minutes, at a temperature of 212 degrees. Remove and solder up the small hole, then plunge into the bath again, and cook for fifteen minutes at a temperature of 212 degrees. A little longer cooking may be necessary if the fruit is hard, or less if it is soft.

If a retort is used, cook for five minutes, at a temperature of 240 degrees. Nectarines and pears do not require cooking so long by two or three minutes in the open bath, and only from three and a half to four and a half minutes in the retort, at a temperature of 240 degrees.

Honey in South Africa.

Mr. Valder, the Government Commercial Agent for New South Wales in South Africa, reports that the Cape Town market is not well supplied with first-class honey, the locally-produced honey being generally of inferior quality, and put up in a very indifferent manner. The imported article is usually obtained in 1-lb. tins, and is also often of poor quality, and as the retail price for same ranges from 1s. to as much as 1s. 6d. per lb. the sale is very small. Mr. Valder sees no reason why a trade in good honey should not be worked up. The quantity of honey imported into South Africa has, during the past five years, varied from 40 up to as much as 80 tons per annum, arriving in about equal quantities through the Cape ports and Durban. Of this, New South Wales has only supplied a very small portion; but provided future shipments are of really first-class quality, Mr. Valder thinks there is a constant demand for a limited quantity of good honey. The supply in the past has been at such high prices, that it practically prohibited the people becoming honey-eaters; but with a good supply at a reasonable price they would, no doubt, soon become consumers on a large scale, and the imports would rapidly increase. In connection with the high retail price, it must be remembered that there is a duty of 2d. per lb. on honey entering South African ports.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of January.

We may expect hot, dry winds this month; but as the season has been remarkably variable up to time of writing, it is quite possible that we may have rain in abundance. If such should be the case, there need be no difficulty in raising all the vegetables required; the main trouble will be in keeping down weeds.

In case of dry weather, deep cultivation and abundance of good dung dug into and thoroughly mixed with the soil, and used as a mulch as well, should do much towards facilitating the production of vegetables of some kind. In out-of-the-way places, away from the haunts of the Chinese gardener, the value of a few vegetables—if only some tomatoes—is almost inestimable, and no doubt anyone determined to do so can, with care and patience, raise something, if every drop of waste water—unused tea, even—be saved for the purpose, and a small wind-break be fixed up as shelter from hot winds.

Speaking about tomatoes, it is probable that the small-fruiting kinds will withstand the effects of dry weather better than the large-fruiting varieties; although the smallest, the "currant" variety, is but a poor growing thing, not worth the growing. The pear-shaped and the bell-shaped are the kinds worth a trial. When planting, be sure to set in a hollow, and not in a bed raised above the surrounding surface, from which any water supplied or rain is sure to run off. With a bed made below the surface every drop will sink in, for it cannot run off. This is an important thing to attend to; and it is really surprising how frequently the mistake is made of adopting the system of raised beds in dry places, both for vegetables and flowers.

Vegetables.

Beans, French or Kidney.—These, probably, will be found difficult to grow wherever the rainfall has been low, for they need a good deal of moisture during their growth; but in moist districts there should be no want of these useful vegetables. Sow according to requirements, once, twice, or oftener, if necessary. All plants which have ceased to produce beans profitably should be removed, and the spaces they occupied made use of for some quite different kind of vegetable, say cabbage, tomato, melon, vegetable-marrow, or anything of a different natural order. If peas follow beans, and then beans again follow the peas, the soil is liable to become "sick" of the same class of plants, and any diseases common to these have splendid opportunities of increasing. It may be as well to mention that tomatoes, egg plants or capsicums had better not follow potatoes, nor potatoes tomatoes, &c., on the same soil; nor should cauliflowers, cabbages, Brussels sprouts, kale, or turnips follow one another, and so on with other vegetables. A little knowledge of botany would be found of much service, either in the garden or on the farm, and now that horticulture and agriculture is likely to be taught in many of our schools, it would be well for the teachers to give those scholars who receive instruction a grounding in the science.

Beet, Silver.—Although this useful vegetable will grow under adverse conditions, in dry seasons, the results are not satisfactory, for the plant needs a good deal of moisture to enable it to produce succulent leaves. If the weather be favourable, and soil moist, young plants may be set out, if any have been raised for the purpose; or seed may be sown if plants are required.

Cauliflowers may be planted out if good strong little plants are ready; but it is not much use planting if the weather and soil are very dry, that is unless abundance of water is available. A little seed should be sown and well looked after. Get the best seed possible, even though the price may seem high.

Cabbage.—Treat just the same as the above. Both of these vegetables need abundance of manure and abundance of moisture, the evaporation from them being enormous during their growth—far greater than anyone who has not studied the subject could imagine. The manure, although needed in abundance, should not be rank, but should be well rotted, otherwise these and kindred vegetables, such as Brussels sprouts and Savoys, will be rank when cooked.

Celery.—Set out a few plants if any are ready for the purpose, if the rainfall is good, or if a good supply of water, suitable for watering, is available. Sow a little seed for future plantings.

Carrot.—Sow a little seed in drills, and be careful to keep the seedlings well weeded as soon as they come up, and thin them out as soon as they are 2 or 3 inches in height.

Endive.—A little seed may be sown, but this is better suited to cool than hot weather, and it might be as well to await chancing loss of seed for the present.

Turnip.—Seed may be sown in small quantity in drills.

Swede.—Sow a small quantity of seed in drills.

Potato.—A few rows of early potatoes should be planted towards the end of the month. Drain well, dig deep, and apply a good dressing of farmyard manure—if well rotted so much the better. Use medium-sized potatoes free from scab for seed, and plant in rows about 3 ft. to 3 ft. 6 in. apart, setting the potatoes about 1 ft. from each other.

Peas.—If the weather is favourable and the soil is in a good moist condition sow a few rows.

Radish.—Sow a few rows from time to time during the month.

Tomatoes.—Seed may be sown if more plants are required. Young tomatoes may be planted, and old, useless plants may be taken up and destroyed.

Flowers.

January is a trying month for flowers if the season is dry, and unless water can be given rather liberally, probably a good many plants will die away. Some take a rest at times and cast many of their leaves—such as roses. These can be pruned back later on, before the wood-buds start into growth, and excellent autumn flowers are likely to follow, especially should the autumn or late summer set in. Sunflowers, portulacas, cockscombs, large ornamental-leaved amaranths, globe amaranths, and celosius should grow satisfactorily if there is any rain at all. Dahlias may still be planted, and advanced plants should be tied up to supports as they increase in height. Remove any suckers that may be seen, and only permit each plant to have a single stem. Use water freely should the weather be dry. Chrysanthemums will need a good deal of water also. Zinnias and balsams will probably produce flowers during the month, and perhaps early-planted asters. With any sort of a favourable season for the remainder of the summer, there should be innumerable flowers in any well looked after garden.

The Destruction of Blackberry Briar.

At various times information has been sought from the Department with regard to the destruction of Blackberry Briar in a less laborious way than by digging or chopping out with a mattock. At the Hawkesbury Agricultural College experiments were carried out in the destruction of Prickly Pear by means of a solution of arsenite of soda sprayed on with the orchard spray-pump. A full account of the method appeared in the *Gazette*, January, 1902.

The matter of treating Sweet Briar and Blackberry Briar in a similar way was referred to Mr. F. B. Guthrie, who suggested that the freshly-cut stems of the plants should be dressed with dry powdered arsenite of soda. The correspondent to whom this was suggested, in a report to the Director of Agriculture, states: that "This was only partially successful, owing, perhaps, to powder purchased not being the best kind, being lumpy, and having no means at his disposal to make it fine—a large quantity fell to the ground, refusing to stick to to the ends of the stems—where it did cling it did its work effectually. However, the idea of applying arsenite of soda was made use of by making a solution of arsenic and soda in the proportion of 1 lb. arsenic to 2 lb. washing soda, and mixing them in 5 gallons of boiling water (the water must be boiling while the mixing takes place). This was applied to the roots, after digging round them, so that the liquid would percolate to the roots. This was most effective; the clump of briar is now quite destroyed."

The cost of treating this particular patch, having an area of about 12 square yards, was about 2s. 6d.; it would, therefore, be too costly for large areas, unless a less quantity proved sufficient to kill the plant than was used in the instance above quoted. Arsenite of soda is a very deadly poison, and under ordinary circumstances contact of living plants with very small quantities is sufficient to kill.

In the experiments carried out at the Hawkesbury Agricultural College the cost of arsenite of soda solution worked out at 2d. for 5 gallons. If, then care is taken to apply the solution without waste by means of a spray-pump, the cost should not be beyond a reasonable amount, and would, without doubt, be cheaper than grubbing by hand. A word of caution with regard to stock running in the same paddock is necessary. Owing to the poisonous nature of arsenite of soda, stock should be removed until the brush has been burnt off. By this means any grass that may have been sprayed will have died and will thus be burnt, and the risk of accident from poison reduced to a minimum.

Farm Notes.

Hawkesbury District—January.

H. W. POTTS.

In no period of the history of the agricultural development of the Hawkesbury district has the year commenced under more favourable conditions in so far as rapid growth is concerned. The rainfall during the latter part of November and early part of last month was ample. Six inches fell in a few days, and moistened the subsoil freely without undue washing. The natural grasses and herbage are abundant and succulent.

"The busiest time on record," is the announcement of our farm foreman, and all through this month it will be so to keep pace with the demand for suppressing weeds and retaining soil moisture by shallow cultivation.

The autumn crops are practically assured, and the outlook for stock feed for next winter is most promising.

All stock are looking well and responding to the fresh spring of grass.

Maize.—The early crops, despite the check they received before the rain came, are now looking well. The later crops demand constant attention to prevent any suspension of growth. The importance of thorough cultivation is very prominent at present; all successful maize-growers realise this. The aim is to maintain a steady, vigorous, and healthy growth. It is fatal to the development of a fully-matured plant to permit of any check at this stage. The characteristic dark-green coloured foliage, the strong, thick, and sturdy stems, are a sign of desirable conditions. The outcome of all tests in this direction point to shallow cultivation as affording the most suitable stimulus. Avoid disturbing or cutting the roots of the plant; should this happen, then other roots are encouraged to grow, and thus weaken the vitality of the main plant. Three inches is now adopted as the standard depth, although in many cases 4 inches has been found a useful depth. For simply conserving soil moisture, a depth of 2 to 3 inches is sufficient, excepting after heavy rainfall, when the soil is apt to cake hard to a greater depth. The matter of frequency of cultivation necessarily is determined by local conditions of soil and climate. The object is to preserve constantly a loose soil surface to check evaporation and to keep down the growth of weeds. Should we get thunderstorms during the month, follow them with prompt cultivation. Even after the plant has attained a height of 3 feet it is good practice to stir the soil in the middle of the row; for this purpose the single cultivator, with a short whipple-tree, is useful. Sowing throughout in all sections has been delayed this season. The varieties especially suitable for fodder purposes and ensilage may be put in, such as Early Mastodon, Hickory King, and Clarke's Mastodon.

Sorghum.—Early Amber, Planters' Friend, Sorghum Saccharatum, and several of the Imphee varieties may be sown throughout the month both for green feed and ensilage. It must be remembered, however, when the seed germinates, and the plant appears, constant cultivation is more essential with this than with maize. Later on, when the plant has assumed full growth, it is hardier than maize, and resists the early frosts of winter. It is not an uncommon sight to see sorghums fed green to stock in July.

Millets.—The final sowings of Hungarian and white French varieties may be made to advantage.

Potatoes.—As anticipated, the early potato crop is not a success, owing to the dry spring season. The later sown crop, however, is looking better, and promises a satisfactory yield. The ground may be prepared this month for the second crop.

Sweet Potatoes.—Planting may be continued. The earlier crops are not fit to dig yet; they promise a good crop.

Pumpkins, Squashes, and Melons.—These crops will require some attention to keep down the weeds, and also some cultivation throughout the month.

Swedes and Mangolds.—The earliest sowings may be made towards the end of the month, after the soil has been brought into fine tilth.

Clarence River District—January.

T. WALDEN HANMER.

Maize may still be planted this month, although rather late for grain, but no doubt many farmers will avail themselves of the chance provided the weather be favourable, owing to the great scarcity and high prices, due to the exceptional dry weather early in the summer. January is always a good month to sow maize for green fodder for dairy cattle, and few, if any, crops are better for milking cows.

Sorghum.—The varieties of the sorghum family may also be sown for green fodder this month.

Pumpkins and Grammas.—These may also be planted this month, and with favourable weather should yield well.

Potatoes.—The first crop of potatoes in this district, like the early maize, proved an almost total failure, and there was in many places a strong second growth. Farmers desirous of planting a late crop would do well to get land ready for planting at the end of present month or early in February.

Millet for broom-making may be planted this month, but early sowings usually are the best.

Full directions for working this crop have been repeatedly given by various writers in the *Gazette*.

Cattle Cabbage.—This is a very valuable crop for dairy-farmers and one that is seldom, if ever, grown in this part of the State. 1 lb. of seed will furnish plants for an acre. Seed-beds for raising the young plants must be made, and when fit they must be transplanted in a manner similar to the ordinary garden cabbage, although more room must be allowed for the plants to grow on account of their extra size. The best results will be obtained from rich land which has been well tilled, and the more manure (whether farmyard or artificial) that can be applied the better yield may reasonably be expected. The most common way of feeding them to cows is to cut off close to the ground and throw them out in the paddock, allowing one good-sized cabbage to each cow, provided of course that the cow has other feed. Where cows are stall-fed they can be given them in their mangers or feed-boxes.

Crops for Green Fodder.—Prepare land for sowing wheat, oats, barley, rape, buckwheat, and tares or vetches, so that a succession of green feed may always be at hand.

It will pay any dairy-farmer, large or small, to have crops of green fodder coming on all through the winter.

Vegetable Garden.—Sow French beans, Swede turnips, white turnips, beetroot, cabbage, lettuce, and peas.

Pine-apples and Bananas may be planted this month.

Glen Innes District—January.

R. H. GENNYS.

Harvesting operations will be fairly well finished by the middle of the month. When these are completed it will be well for farmers who possess sheep—and every holder should, if possible, keep a few—to turn them into the cultivation paddocks to eat off all weeds before they have a chance of seeding; the land will also be much enriched by their manure, and the animals themselves much benefited at a time when grass is often very dry and lacking in nutriment.

For green fodder the following may be sown:—*Maize, Sorghums, Millets.* Sow these thickly. *Barley* may also be sown for green feed.

Swedes and *Turnips* may also be sown this month, also *Beans, Cabbages, Cauliflowers.*

Some *Potatoes* may still be planted if required.

Land may be turned over a first time with advantage this month.

Cultivation of Growing Crops.—This must in all cases be persevered with, where practicable; in crops such as maize, potatoes, &c., the cultivation should get shallower as the plant matures, in order not to cut or injure the roots near the surface, as these are most important. Weeds must be kept down, and the frequent stirring conserves moisture about the roots of the plants. Do not imagine the ground is ever too dry for light cultivation, and, although the dust may be flying all the time, the good that is done at this stage is almost incalculable.

In the *Orchard* keep the cultivator going in order to destroy weeds and keep the moisture about the trees from escaping.

Riverina District—January.

G. M. McKEOWN.

On the completion of harvest it will be found advantageous to turn as many sheep as possible on to the stubbles to clean up as much of the fallen grain as possible. The trampling of the sheep also covers a quantity of the grain with a thin covering of earth, and places it in a position to germinate after a light rainfall, which at times is received at this period in occasional thunderstorms. By the help of sheep, therefore, oats and other grain which might later become a source of trouble may be greatly reduced, and at the same time may be made a source of profit.

Fallowed land should be harrowed, or lightly scarified, to assist it to retain moisture.

As soon as possible after having been well grazed by sheep, stubble land which is to be cropped should be ploughed to place it in a condition to receive and retain moisture to the greatest possible extent. For this purpose the rotary disc-plough will be found the most suitable implement, as it can be used in dry districts such as this much earlier than any other machine.

Rape and Swedes.—Land which has been fallowed should be kept in good condition for sowing Swedes as early as the rainfall will admit, as field crops should be sown at latest in February.

Rape, however, may be sown up to April, but March sowing will be found preferable.

Other land intended for sowing should be prepared as early as possible, so as to admit of early sowing of either crop.

Pumpkins, Squashes, and Melons.—The surface of the land between the plants should be kept lightly stirred to conserve moisture, and where water is available for economical application it should be used in dry parts. Vines should be so trained as to shelter their own roots, and they should not be allowed to straggle at will. Fruitfulness may be improved by pinching back the vines which have a tendency to make a rank straggling growth.

Crown Lands of New South Wales.

THE following areas will be available for selection on and after the dates mentioned:—

H.S. No.	Name of Land District.	Holding, &c.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Annual Rental per Block.	Date available.
					FOR HOMESTEAD SELECTION.			
			acres.		acres.		£ s. d.	1906.
*993	Coonabarabran	....	916	10	40 to 113½	Coonabarabran, ¾ to 2¾.	0 10 0 to 2 9 8	18 Jan.
					FOR SETTLEMENT LEASE.			
S.L. No.			acres.		acres.		£ s. d.	1906.
*822	Gunnedah ..	....	....	1	4,860	Tambar Springs, 3; Gunnedah, about 48.	20 5 0	4 Jan.
*823	Walgett ..	Mourabie ..	7,937	2	3,015 & 4,922	Walgett, 28 and 32 respectively.	56 10 8 and 92 5 10	11 ,,
*824	Narrabri ..	Burren	15,895a. 2r. 30p.	3	4,798 to 5,791	Narrabri, 64 to 65; Burren Junction, 5 to 10.	89 19 3 to 108 11 8	18 ,,

FOR IMPROVEMENT LEASE.

Block Numbers.	Land District or Place of Sale.	Name of Holding.	Total Area.	No. of Blocks.	Area of Blocks.	Distance in Miles from nearest Railway Station or Town.	Upset Annual Rental per Block.	Date of Sale or Tender.
			acres.		acres		£ s. d.	1906.
967	Wyalong ..	Kolkibertoo	....	1	16,000	Ungarie, 16; Wyalong, 30.	45 0 0 (Inclusive of use of Crown improvements.)	Sale, 5 Jan.
1,359	Warren	Gillendoon	....	1	1,734	Warren, 3 to 8	10 16 9	5 ,,
1,361 and 1,362	Warren	Weelah and Gradgery.	3,507	2	1,340 & 2,167	Warren, 40	16 15 0 and 36 2 4	5 ,,
659, 662 †(681 and 682) †683 and 684	Nyngan ..	W. Bogan Scrubbed Lands, partly within New Babinda Holding.	27,607	4	4,880 to 9,604	Hermidale, 23 to 28.	10 3 4 to 30 0 3	9 ,,
1,330 and 1,331	Dubbo	Ganber, Ganber East	9,940	2	5,000 & 4,940	Cobborah, 4; Dubbo, 36.	7 18 4 and 7 16 5	9 ,,
610	Rylstone ..	....	....	1	760	Capertee, 6; Torbane, 1½.	6 6 8	9 ,,
1,334 and 1,335	Condobolin	Euglo	5,620	2	5,080 and 540	Condobolin, 30	45 0 0 and 4 0 0	9 ,,
605	Bombala ..	....	....	1	3,190	Bombala, 3½	18 12 2	15 ,,
613 and 614	Albury	....	1,070	2	630 and 440	Albury, 6½	23 12 6 and 12 16 8	15 ,,
611	Boorowa ..	....	....	1	350	Crookwell, 35	4 7 6	15 ,,
1,363	Coonabarabran.	....	....	1	2,870	Gilgandra, 50	17 18 9	Tender, 15 Jan.

* For original holdings only. † As one block.

For Conditional Purchase.

Land District.	Name of Holding, &c.	Total Area.	Parish.	County.	Price per Acre.	Date available.
		a. r. p.			£ s. d.	1906.
Armidale ..	Oban and Aberfoyle	895 0 0	Oban	Clarke ..	1 0 0	8 Feb.
,, ..	....	525 2 0	Hillgrove	Sandon ..	1 0 0	8 ,,
,, ..	....	4,200 0 0	Cameron and Baker	Hardinge ..	1 0 0	15 ,,
Bathurst ..	....	420 0 0	Oakley	Bathurst ..	0 16 8	8 ,,
,, ..	....	1,540 0 0	Balfour	Westmoreland	0 18 4	8 ,,
,, ..	....	580 0 0	Adderley	,,	1 10 0	8 ,,
*Bellinger ..	....	115 0 0	Moonpar and Blicks	Fitzroy ..	1 10 0	18 Jan.
Boorowa ..	....	96 0 0	Barnett	King	1 0 0	22 Feb.
Braidwood ..	....	40 0 0	Jinglemoney ..	Murray ..	1 0 0	1 ,,
*†Carcoar ..	within Barry Suburban Lands.	120 3 3	Neville	Bathurst ..	2 10 0	18 Jan.
Casino ..	within Resumed Area, 375.	13,000 0 0	Barrawonga and Drake.	Richmond ..	0 15 0	4 ,,
*Coonamble ..	....	2,547 2 0	Quonmoona ..	Leichhardt ..	1 12 6	18 ,,
Corowa ..	Kentucky and Quat Quatta.	1,096, 513½, and 180¾.	Richmond, Kentucky, &c.	Hume ..	1 6 8 2 0 0 and 2 10 0 respt'vly.	8 Feb
,, ..	....	393 0 0	Kentucky	,, ..	2 0 0	8 ,,
*Forbes ..	....	320 0 0	Jemalong	Forbes ..	2 0 0	1 ,,
*†Grafton ..	within Lawrence Population Area.	247 0 0	Lawrence	Clarence ..	1 10 0	4 Jan.
Grafton ..	....	86 0 0	Gulmarrad	,, ..	1 0 0	22 Feb.
Gundagai ..	....	116 0 0	Childowla	Buccleugh ..	0 13 4	4 Jan.
Gunnedah ..	....	10,125 0 0	Lawson, Trinkey, &c.	Pottinger ..	0 5 0	8 Feb.
*† ,, ..	within Gunnedah Population Area.	24 3 20	Gunnedah	,, ..	12 10 0	4 Jan.
*Lismore ..	....	91 2 0	Dunoon	Rous	3 0 0	22 Feb.
* ,, ..	....	478 3 0	Nimbin	,, ..	2 0 0	11 Jan.
Lithgow ..	....	555 0 0	Hartley	Cook	1 0 0	15 Feb.
Mudgee ..	....	2,320 0 0	Botobolar and Price	Phillip ..	0 10 0	1 ,,
Rylstone ..	....	390 0 0	Goongal	Roxburgh ..	0 16 8	1 ,,
,, ..	....	280 0 0	,, ...	,, ..	1 0 0	1 ,,
Taree	....	285 0 0	Lansdowne	Macquarie ..	1 0 0	1 ,,
Tenterfield ..	....	65 0 0	Timbarra	Clive	1 0 0	1 ,,
*Wagga Wagga	Borambola	455½, 227½, and 227½.	Cunningdroo ..	Wynyard ..	2 0 0 2 10 0 and 3 0 0 respt'vly.	8 ,,
Warialda ..	....	220 0 0	Hadleigh	Burnett ..	1 0 0	15 ,,

* For original holdings only. † Also set apart as special area.

Conditional Purchase Lease.

Land District.	Holding, &c.	Total Area.	No. of Blocks.	Parish.	County.	Annual rent.	Date available.
Urana ..	Noweronie.	acres. 10,880	17 blocks of 640a. each	Palmer and Boreegerry.	Urana	2½ per cent. of capital values, which range from £1 15s. to £2 5s. per acre.	1 Feb., 1906.

Special Areas.

Grafton Land District, within the Lawrence Population Area, 247 acres, in parish Lawrence, county Clarence; maximum and minimum area, 247 acres; price, £1 10s. per acre. Available for original applications only on 4th January, 1906. (Also set apart as Original Conditional Purchase.)

Gunnedah Land District, within the Gunnedah Population Area, 24 acres 3 roods 20 perches, in parish Gunnedah, county Pottinger; maximum area, 7 acres 3 roods 6 perches; minimum area, 5 acres; price, £12 10s. per acre. Available for original applications only on 4th January, 1906. (Also set apart as Original Conditional Purchase.)

Carcoar Land District, within the suburban boundaries of Barry, 120 acres 3 roods 3 perches, in parish Neville, county Bathurst; maximum area, 7 acres 0 roods 24 perches; minimum area, 1 acre 2 roods 1 perch; price, £2 10s. per acre. Available for original applications only on 18th January, 1906.

AGRICULTURAL SOCIETIES' SHOWS.

1906.

Society.	Secretary.	Date.
Albion Park A., H., and I. Society	Henry Fryer ...	Jan. 17, 18
Gosford A. and H. Association	W. E. Kirkness ...	,, 26, 27
Kiama Agricultural Association	Jas. Somerville ...	,, 26, 27
Berry Agricultural Association	A. T. Colley ...	Jan. 31, Feb. 1, 2
Alstonville Agricultural Society	J. C. Foster ...	Feb. 7, 8
Central Cumberland A. and H. Association, Dural ...	H. A. Best ...	,, 7, 8
Moruya A. and P. Society	John Jeffery ...	,, 7, 8
Wollongong A., H., and I. Association (Wollongong)	J. A. Beatson ...	,, 8, 9, 10
Manning River A. and H. Association...	S. Whitehead ...	,, 15, 16
Guyra P., A., and H. Association	H. W. Vincent ...	,, 21, 22
Lithgow A., H., and Produce Society	H. N. Jolliffe ...	,, 21, 22
Ulladulla Agricultural Association	C. A. Buchan ...	,, 21, 22
Liverpool A., H., and A. Society	P. A. Shepherd ...	,, 28, Mar. 1
Gunning P., A., and H. Society	Ernest E. Morgan	Mar. 1, 2
Robertson A. and H. Society	R. G. Ferguson ...	,, 1, 2
Campbelltown A., H., and I. Society	A. R. Payten ...	,, 6, 7
Tenterfield Intercolonial P., A., and Mining Association	F. W. Hoskin ...	,, 6, 7, 8
Bega A., P., and H. Society	John Underhill ...	,, 7, 8
Walcha P. and A. Association	S. Hargrave ...	,, 7, 8
Macleay A., H., and I. Association	E. Weeks... ...	,, 7, 8, 9
Fair days	....	,, 9, 10
Narrabri P., A., and H. Association	J. McCutcheon ...	,, 7, 8, 9
Nepean District A., H., and I. Society, Penrith ...	E. K. Waldron ...	,, 8, 9
Berrima A., H., and I. Association (Moss Vale) ...	James Yeo ...	,, 8, 9, 10
Bombala Exhibition Society	W. G. Tweedie ...	,, 13, 14
Cumnock I., A., and H. Association	W. L. Ross ...	,, 14
The P. and A. Association of Central New England, Glen Innes	Geo. A. Priest ...	,, 13, 14, 15
Clarence P. and A. Society, Grafton	T. T. Bawden ...	,, 14, 15
Camden A., H., and I. Association	A. Thompson ...	,, 14, 15, 16
Oberon A., H., and P. Association	W. Minehan ...	,, 15, 16
Newcastle and District A., H., and I. Association ...	Owen Gilbert ...	,, 15, 16, 17
Lower Clarence Agricultural Society, Maclean ...	George Davis ...	,, 20, 21
Cobargo A., P., and H. Society	T. Kennedy ...	,, 21, 22
Gundagai P. and A. Society	A. Elworthy ...	,, 21, 22
Blayney A. and P. Association	H. R. Woolley ...	,, 21, 22
Crookwell A., P., and H. Association	C. T. Clifton ...	,, 22, 23
Tamworth Agricultural Association	J. R. Wood ...	,, 27, 28, 29
Molong P. and A. Association	C. J. V. Leathem	,, 28
Durham A. and H. Association, Dungog	C. E. Grant ...	,, 28, 29
Mudgee Agricultural Society	J. M. Cox... ...	,, 28, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 4, 5
Bathurst A., H., and P. Association	W. G. Thompson	,, 4, 5, 6
Warialda P. and H. Association	W. B. Geddes ...	,, 4, 5, 6
Richmond River A., H., and P. Association (Casino)	E. J. Robinson ...	,, 5, 6
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	,, 24, 25, 26, 27, 28
Orange A. and P. Association	W. Tanner ...	,, 25, 26, 27
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Upper Manning A. and H. Association	Edw. Rye... ...	,, 3, 4
Moree P. and A. Society...	S. L. Cohen ...	,, 8, 9, 10
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Murrumbidgee P. and A.	A. F. D. White ...	,, 22, 23
Junee P., A., and I. Association	T. C. Humphrys...	Sept. 5, 6
Young P. and A. Association	Geo. S. Whiteman	,, 12, 13
Yass P. and A. Society	W. Thomson ...	,, 26, 27

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3. Bulls leased will be transferred free of charge to any place not more than 100 miles by rail from the place from which they are transferred; to any place distant more than 100 miles by rail, lease will be granted only on condition that the lessee pays all charges for the extra distance over 100 miles. In the case of bulls sent by sea, or partly by rail and partly by sea, all expense over the sum of £1 (one pound) must be borne by the lessee. The lessee must make all arrangements for, and bear all expense of, transferring a bull from the nearest railway station or port to the place where it is to be stationed. In the case of leasing a bull already stationed within the district, the new lessee must send for the bull and bear the expense of removal.

4. A condition of the leasing of the bulls shall be that the farming public be allowed to send cows to the bull at a fee of not more than 10s. (ten shillings) per cow, provided the bull's list is not already full, but the total number of cows served must not be more than thirty for six months.

5. Each bull shall be treated and kept in a condition to satisfy the Department, and shall be at all times open to inspection of authorised Officers of the Department.

6. A return showing the number of cows served, and distinguishing between cows owned by those to whom the bull is leased and the outside public, shall be sent to the Department at the end of the term.

7. All due care must be taken to see that the bull shall not have access to cows suffering from any infectious disease, special attention being given to pleuro-pneumonia and tuberculosis.

8. No farmer who is known to have pleuro-pneumonia in his herd shall be permitted to send cows to any of these bulls within three months from the date of the last outbreak.

9. In case of illness of a bull the Department shall be immediately informed.

10. The bull shall not be allowed to run with cows, but shall be kept in a special bull paddock, which must be well fenced, and each cow "in use" shall only be allowed to remain with the bull such time as will enable him to have connection with her twice. However, where necessary, in order to keep bulls quiet, special permission may be given to run with one or two specially-selected healthy cows.

11. Should any of the foregoing rules not be complied with, the Department shall have the right to remove the bulls at once, and all fees paid shall be forfeited.

12. Should a bull be wilfully neglected or badly treated, the Department shall have the right to take any action desirable for the recovery of damages.

13. All applications for bulls should be made to the Director of Agriculture, Department of Agriculture, Sydney.

AGREEMENT CLAUSE.

In consideration of the loan of one Stud Bull ( ) for a period of
I, of do hereby agree to be bound by the conditions expressed in the foregoing Regulations

Dated this day of **190 .**

Witness,— *Lessee.*

J.P.

Duty Stamp.
One Shilling.

N.B.—This agreement must be signed on the day the bull is received by the lessee, and is to be returned by first post to the Director of Agriculture.

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BREED.	*AGE.*	*SIRES.*	*DAMS*	*PRICE (each)* £ s. d.
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Do ...	do ...	Ginger (1st prize R.A. Show)	...	do

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Yorkshire, Large.	3 months .. 5 months .. 6–7 months	Laurier-Jason (imp.) ...	Pure Bred Sows ...	3 3 0 4 4 0 5 5 0
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Acting Director of Government Asylums.


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